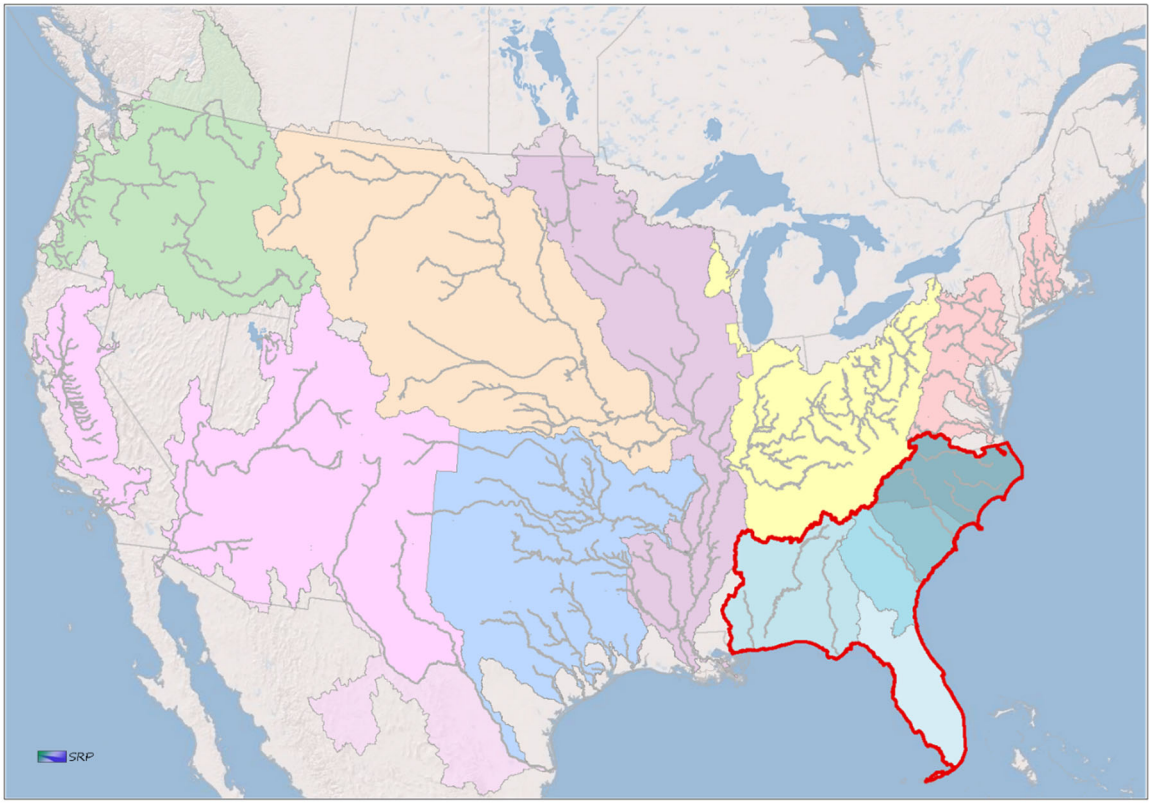
Sustainable Rivers Program

# Environmental Opportunities for Rivers and Reservoirs in the South Atlantic




Regional Operations and Water Management Meeting

South Atlantic Division and Charleston, Jacksonville, Mobile, Savannah, and Wilmington Districts

April 2023

## Executive Summary

The South Atlantic Operations and Water Management Meeting was held February 7-8, 2023. The purpose of the meeting was to identify environmental improvement opportunities at U.S. Army Corps of Engineers (Corps) involved reservoirs and related Civil Works water management infrastructure in the South Atlantic region that are feasible to implement and are likely to provide compelling potential benefits. This report documents the meeting and the discussions held in plenary and breakout sessions. This is not a decision document; no specific recommendations are made. However, this report is intended for use by district and regional Corps staff considering opportunities and priorities for environmental improvement at water management infrastructure in the South Atlantic region.

The South Atlantic region is defined as the geographic area containing five Corps Districts within South Atlantic Division (SAD): Charleston (SAC), Jacksonville (SAJ), Mobile (SAM), Savannah (SAS), and Wilmington (SAW). Districts are responsible for Corps Civil Works water resource projects within a geographic area that encompasses major river basins to include the Roanoke, Cape Fear, Neuse, Yadkin, Savannah, Alabama, and Chattahoochee Rivers. Additional responsibilities include management of Cape Fear Locks & Dams (SAW), Lake Okeechobee Water Conservation Areas (SAJ), New Savannah Bluff Lock & Dam (SAS), and Tennessee-Tombigbee Waterway (SAM) (Figure 1). More than fourteen (14) reservoirs, affecting flows for over 2,933 river miles within the region, were considered.


Figure 1. Geographic scope of the South Atlantic Regional Meeting.

In formulating and evaluating environmental opportunities, location-based teams followed these steps:

1) list possible environmental improvement actions associated with reservoirs and water management infrastructure;
2) rate environmental potential of each action;
3) rate degree to which each action has been implemented;
4) select environmental actions with unrealized implementation; and,
5) rank reservoirs and water management infrastructure according to which are most promising for operational changes related to selected actions.

Identified actionable ideas, or combinations of environmental action and candidate reservoir or other water management infrastructure, are highlighted in the report and summarized in Table 1.

Table 1. Priority actionable ideas, South Atlantic region.

| **Location-based team** | **Environmental Action** | **Reservoir(s)*** |
|---|---|---|
| Charleston | Water quality downstream | Cooper River Rediversion Project |
| Charleston | Fish passage | Cooper River Rediversion Project |
| Charleston | Recreation | Cooper River Rediversion Project |
| Jacksonville | Management of harmful algal blooms (prevent anoxic conditions in pool) | Lake Okeechobee |
| Jacksonville | Restrict passage of invasives | Water Conservation Area 3A, Lake Okeechobee, Water Conservation Area 1, Water Conservation Area 2B, Water Conservation Area 2A, Kissimmee Chain of Lakes and Kissimmee River, Water Conservation Area 3B, Portugues and Bucana (P&B) Rivers Project |
| Jacksonville | Manage distribution of depositing sediments | Lake Okeechobee |
| Jacksonville | Sediment management - bed and bank | Portugues and Bucana (P&B) Rivers Project |
| Mobile | Fish passage (connect up and down) | Seminole (Woodruff), ARL Claiborne |
| Mobile | Downstream water quality/minimum flow | Lake Sidney Lanier, Lake Allatoona, Walter F. George Lake, West Point Lake, Okatibbee Lake, TTW Canal, Carters Lake |
| Mobile | Downstream floodplain management | Seminole (Woodruff), Okatibbee Lake, TTW Canal |

| | | |
|---|---|---|
| Mobile | Downstream rate of change management | Okatibbee Lake, TTW Canal, West Point Lake |
| Mobile | Sediment management | TTW Canal, TTW River, TTW Bay Springs Lake, BWT |
| Mobile | Fish spawning (in pool) | Lake Sidney Lanier, Lake Allatoona, Seminole (Woodruff), Okatibbee Lake, West Point Lake, Walter F. George Lake |
| Mobile | Fish spawning (downstream) | Lake Sidney Lanier, Carters Lake |
| Savannah | Life stage support – Fisheries | Hartwell Lake, J. Strom Thurmond Lake, Richard B. Russell Lake, New Savannah Bluff Lock and Dam (Savannah River below Augusta Project) |
| Savannah | Physical habitat creation (oxbows/floodplain restoration) | New Savannah Bluff Lock and Dam (Savannah River below Augusta Project) |
| Wilmington | Environmental flows - water quality | B. Everett Jordan Lake |
| Wilmington | Environmental flows - fish passage | B. Everett Jordan Lake, Falls Lake |
| Wilmington | Sedimentation study - reallocation of sediment pool for environmental flows | B. Everett Jordan Lake |
| Wilmington | Sediment management primarily to support fish passage locking efforts | William O Huske (Cape Fear River Lock and Dam #3) |
| Wilmington | LD connect US/DS - modifications for fish passage | William O Huske (Cape Fear River Lock and Dam #3) |
| Wilmington | LD connect US/DS - locking - fish passage | William O Huske (Cape Fear River Lock and Dam #3) |

*Alabama River Lakes (ARL); Tennessee-Tombigbee Waterway (TTW); Black-Warrior-Tombigbee (BWT)

Meeting participants (Appendix A) were comprised of staff from the Corps, including representatives of SAD and the five districts, and The Nature Conservancy (TNC).

This report details content of the meeting and is structured to follow the meeting agenda (Appendix B).

The South Atlantic meeting was the fifth in a series of regional Operations and Water Management meetings. Previous regional meetings were conducted in the Upper Midwest (involving Kansas City, Omaha, Rock Island, St. Paul, and St. Louis districts) in September 2019, South (involving New Orleans, Memphis, Vicksburg, Galveston, Little Rock, Fort Worth, and Tulsa districts) in September 2020, Pacific Northwest (involving Seattle, Portland, and Walla Walla districts) in November 2020, and North Atlantic (involving Baltimore, New England, New York, Norfolk, and Philadelphia districts) in October 2021.

## Introduction and Objective

The goal of the South Atlantic Regional Operations and Water Management meeting was to identify environmental opportunities at Corps-involved reservoirs that are feasible to implement and are likely to provide compelling potential benefits.

By many measures (e.g., number of reservoirs, total storage, geographic distribution), the Corps is the largest water management organization in the nation. A reservoir survey completed in 2013 identified 465 reservoirs with federally authorized flood storage. The majority (356) of these reservoirs were owned and operated by the Corps. Additionally, the Corps has approximately 180 locks and dams on rivers nationwide. Considering environmental opportunities for all of these water bodies is daunting given differences in their size, location, and purpose(s).

Contemplating opportunities at finer spatial scales becomes more practical as similarities in hydrology, landscape, water bodies, and water resources management create a common context for sharing experiences and formulating alternative management strategies. Environmental opportunities and challenges also trend regionally, as considerations begin to focus on shared ecological community types, flyways, and habitats. The South Atlantic Regional Operations and Water Management meeting was convened with this premise – that regional characteristics of water and ecological systems can underpin a productive dialogue about water management infrastructure operations for environmental benefits.

Meeting participants provided expertise in water management infrastructure operations, water management, water quality, natural resources management, environmental planning, and ecology. Collectively, the group began the formulation process by listing key environmental actions associated with water management infrastructure. Participants then split into location-based teams (based on geographical areas of responsibility of the five participating Corps districts and experience). Each team scored the potential environmental benefits and current implementation feasibility level of each identified action (for all water management infrastructure, collectively). Teams then ranked specific actions with unrealized environmental benefits for individual projects within their area, according to which were the most promising candidates for operational changes and selected highest ranked actions to carry forward.

## Sustainable Rivers Program

The Sustainable Rivers Program (SRP) is a national partnership between the Corps and TNC. The mission of SRP is to improve the health and life of rivers by changing water management infrastructure operations to restore and protect ecosystems, while maintaining or enhancing other authorized project purposes.

The SRP began in 1998 with an initial collaboration to improve the ecological condition of the Green River, Kentucky. The Program was formally established in 2002 and included eight river systems. As of 2022, the SRP includes more than 90 Corps water management infrastructure projects in 44 river systems influencing 12,069 river miles (Figure 2). It is the largest scale and most comprehensive program for implementing environmental flows below Corps reservoirs.

Environmental flows are defined as the quantity, timing, and quality of water flows required to sustain ecosystems. For water management infrastructure operators, environmental flows manifest as management decisions that manipulate water and land-water interactions to achieve ecological or environmental goals. The SRP process for environmental flows has three phases: (1) advance; (2) implement; and (3) incorporate. Advancing environmental flows involves engaging stakeholders in a science-based process to define the flow needs of riverine ecosystems. Implementation involves testing the effectiveness and feasibility of the defined flows. Incorporation involves formally including environmental flow strategies in reservoir operations policy (e.g., water control manual updates). Environmental flows were the founding objective of the SRP and remain the key focus. In recent years, the Program began exploring other water management infrastructure-oriented actions with potential to produce environmental benefits.

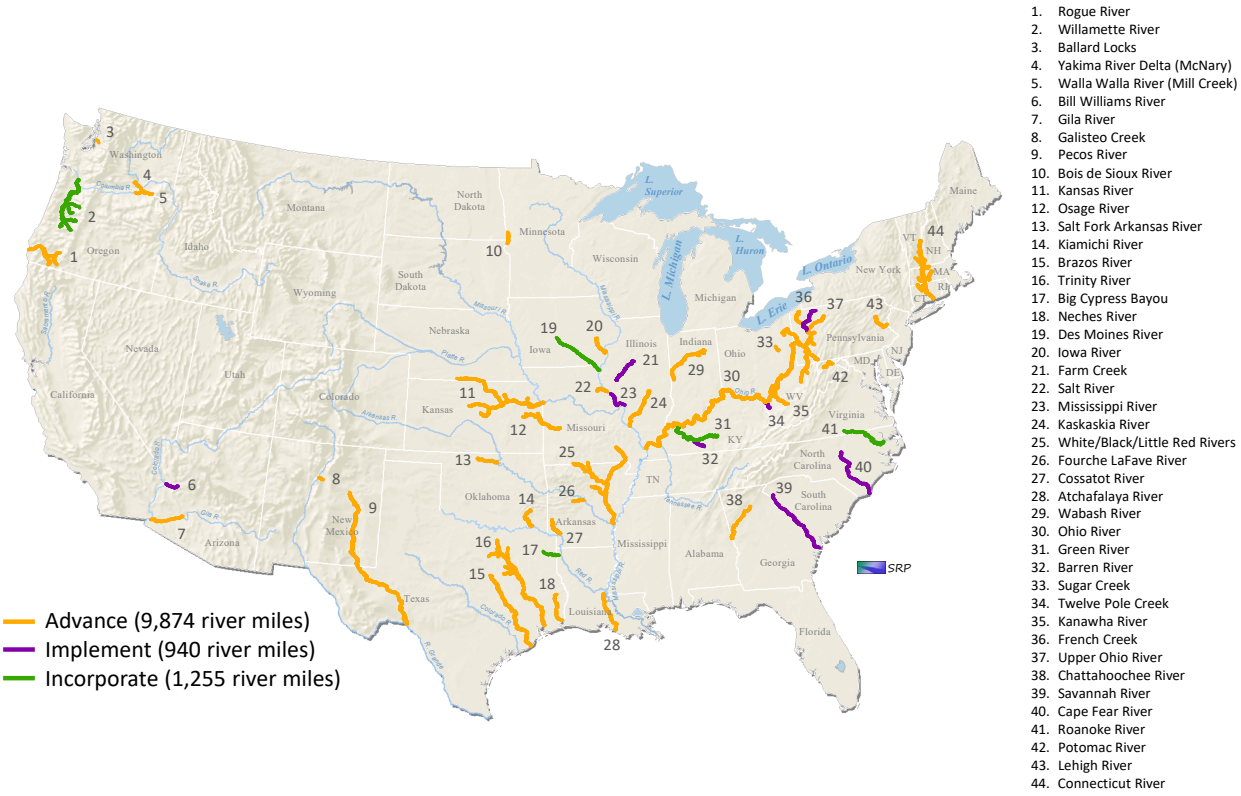



Figure 2. Status of rivers engaged in the Sustainable Rivers Program, 2022.

Importantly, this report and associated meeting are not about SRP. SRP has promoted the concept of regional meetings for several years with the intent of providing a venue for broad consideration of environmental actions at rivers and reservoirs. The South Atlantic meeting was the fifth in a series of regional Operations and Water Management meetings sponsored by the SRP. Previous regional meetings were conducted in the Upper Midwest (involving Kansas City, Omaha, Rock Island, St. Paul, and St. Louis districts) in September 2019, South (involving New Orleans, Memphis, Vicksburg, Galveston, Little Rock, Fort Worth, and Tulsa districts) in September 2020, Pacific Northwest (involving Seattle, Portland, and Walla Walla districts) in November 2020, and North Atlantic (involving Baltimore, New England, New York, Norfolk, and Philadelphia districts) in October 2021.

## South Atlantic Regional Rivers and Reservoirs

For the purposes of this meeting, the South Atlantic region is contained within the Corps' South Atlantic Division's (SAD) five Districts: Charleston (SAC), Jacksonville (SAJ), Mobile (SAM), Savannah (SAS), and Wilmington (SAW). Collectively, the districts are involved with management of 14 reservoirs with federally authorized flood space. Almost all (13) of these projects are owned and operated by the Corps. The other (1) is owned and operated by entities other than the Corps, with the Corps prescribing guidance for the management of the federal authorized flood space (Figure 3). This type of reservoir is often referred to as a Section 7 reservoir in reference to the portion of the Flood Control Act of 1944 that authorized the Corps to prescribe regulations for the use of reservoir storage dedicated to flood risk management for all facilities constructed wholly or in part with federal funds. There are no dry dams in the South Atlantic Region.

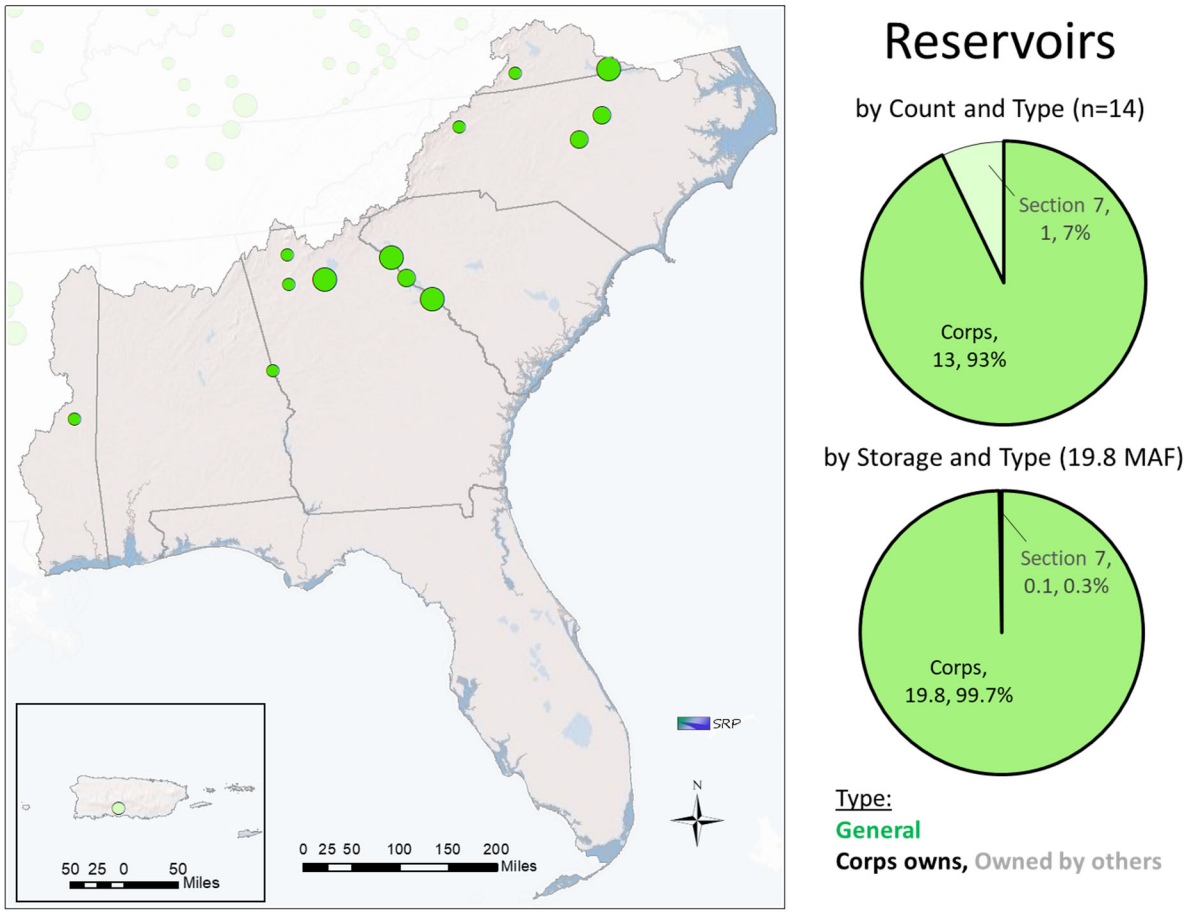



Figure 3. Corps-involved reservoirs in the South Atlantic region. Excludes Corps locks and dams.

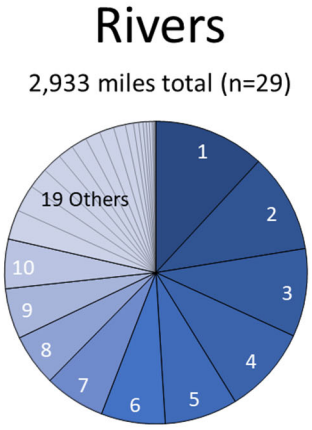
Based on the National Inventory of Dams (NID 2016), Corps involved dams contain 19.8 million acre-feet (MAF) of storage, which is 26% of all surface water reservoir storage in the region. Table 2 provides a summary of the reservoirs. There are no reservoirs in Charleston District with federally authorized flood space.

Table 2. South Atlantic region reservoir count and storage. Corps locks and dams are excluded from the "Corps - Count" and "Corps - Storage" tallies.

| | Count | | | | | Storage (millions of acre-feet; MAF) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Corps | | Section 7 | | NID (all) | Corps | | Section 7 | | NID (all) |
| | General | Dry dams | General | Dry dams | | General | Dry dams | General | Dry dams | |
| SAC | - | - | - | - | 2,027 | - | - | - | - | 9.6 |
| SAJ | - | - | 1 | - | 1,184 | - | - | 0.1 | - | 23.8 |
| SAM | 5 | - | - | - | 6,541 | 4.4 | - | - | - | 17.2 |
| SAS | 3 | - | - | - | 2,889 | 8.7 | - | - | - | 13.4 |
| SAW | 5 | - | - | - | 3,241 | 6.7 | - | - | - | 12.8 |
| Total | 13 | - | 1 | - | 15,882 | 19.8 | - | 0.1 | - | 76.9 |

The river network below the Corps-involved reservoirs consists of 29 different named rivers. The Chattahoochee is the longest with a total of 348 river miles from Buford Dam to its confluence with the Flint River, where the two form the Apalachicola River, which flows on through the panhandle of Florida to the Gulf of Mexico. The Alabama River has the second longest length within the region with the Coosa, Savannah, Neuse, Roanoke, Cape Fear, Yadkin, Chickasawhay, and Great Pee Dee completing the list of top ten longest rivers (Figure 4).

The total number of river miles in the region below Corps involved dams is 2,933. Of these, approximately 2,923 river miles are below Corps dams and 9 are below the Section 7 dam. All of these river miles (2,933) are below reservoirs that have an authorized purpose related to environmental stewardship (e.g., fish and wildlife, water quality, or recreation). Table 3 provides a summary of the rivers.


| # | Name | Miles |
|---|---|---|
| 1 | Chattahoochee River | 348 |
| 2 | Alabama River | 311 |
| 3 | Coosa River | 276 |
| 4 | Savannah River | 274 |
| 5 | Neuse River | 229 |
| 6 | Roanoke River | 201 |
| 7 | Cape Fear River | 191 |
| 8 | Yadkin River | 163 |
| 9 | Chickasawhay River | 158 |
| 10 | Great Pee Dee River | 155 |
| 11... | 19 Others | 628 |
| Total | | 2,933 |

Figure 4. Rivers below Corps-involved reservoirs in the South Atlantic region.

Table 3. River miles below Corps involved dams. Tallies provided per ownership type and purpose.

| | River Miles by Ownership | | | River Miles by Purpose | | | | |
|---|---|---|---|---|---|---|---|---|
| | Corps | Section 7 | Both | Enviro | Hydro | Both | Neither | Total |
| SAC | 173 | 0 | 0 | 173 | 0 | 0 | 0 | 173 |
| SAJ | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 9 |
| SAM | 1,487 | 0 | 0 | 275 | 0 | 1,212 | 0 | 1,487 |
| SAS | 284 | 0 | 0 | 0 | 0 | 284 | 0 | 284 |
| SAW | 979 | 0 | 0 | 644 | 0 | 335 | 0 | 979 |
| Total | 2,923 | 9 | 0 | 1,102 | 0 | 1,831 | 0 | 2,933 |

## Reservoir-centric Environmental Efforts within the SAD Region

This section provides a summary of presentations from the five participating districts about ongoing reservoir-centric environmental efforts in the region.

### Charleston District (SAC)

St. Stephen Powerhouse Dam (Hydropower Facility) is located approximately 1.5 miles north of St. Stephen, South Carolina. The dam is part of the Cooper River Rediversion Project (CRRP; Figure 5), which was constructed to reduce shoaling and attendant maintenance costs to the Charleston Harbor. The project also restored the historic saline regimen to the Cooper River and Charleston Harbor. The CRRP was authorized by the Rivers and Harbor Act of 1968, Section 101, P.L. 90-483 (S.D. 88, 90th Congress, 13 August 1968) modified by P.L. 102-104 and further modified by Section 353, P.L. 104-303.

The CRRP is associated with the Lakes Marion and Moultrie projects (Figure 6). Lakes Marion and Moultrie were created in the 1940s by damming the Santee and Cooper Rivers. Wilson Dam was constructed across the Santee River forming Lake Marion. Pinopolis Dam was constructed across the Cooper River forming Lake Moultrie. An unrestricted canal, called the Diversion Canal, connects the lakes. The only spillway for both lakes is located at Wilson Dam. Pinopolis Dam can only release water via the turbines at its Jefferies Hydroelectric Station. After construction of Lakes Marion and Moultrie, shoaling increased significantly in the Charleston Harbor. In the 1980s, the U.S. Army Corps of Engineers (USACE) constructed the CRRP with the purpose of mitigating this shoaling. The CRRP consists of an entrance channel, intake canal, powerplant/dam, fish lift facilities, tailrace canal, dikes which parallel the intake canal, and access and patrol roads (Figure 7). The canal, called the Rediversion Canal, was constructed from the north side of Lake Moultrie to the Santee River. The canal allows flow from the Lake to the Santee River, as opposed to flow being released down the Cooper River. The St. Stephen hydropower facility was constructed across the Rediversion Canal for the purpose of mitigating power losses at Jefferies Hydroelectric Station since flows had to be minimized into the Cooper River.

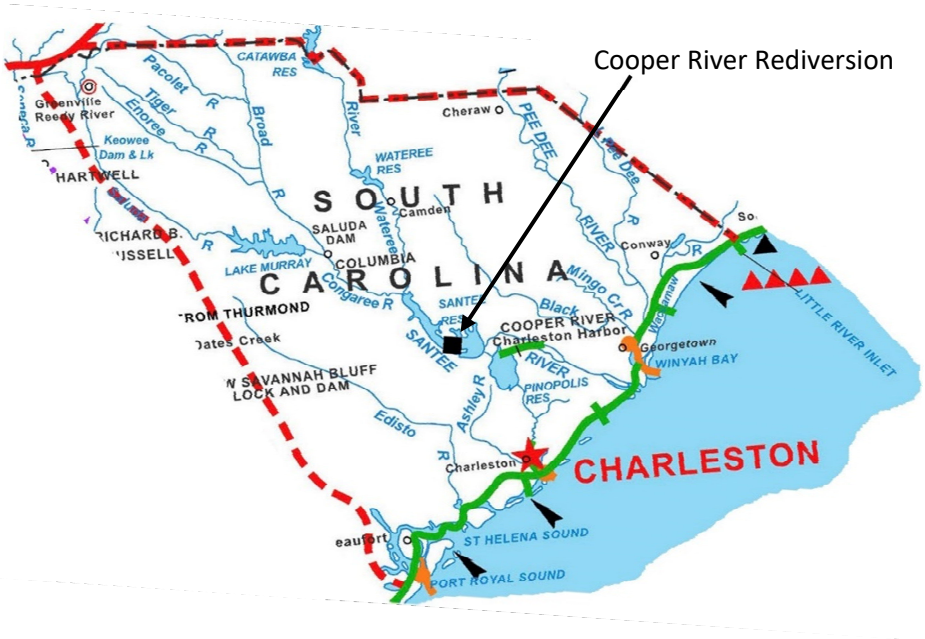



Figure 5. Charleston District project location map.

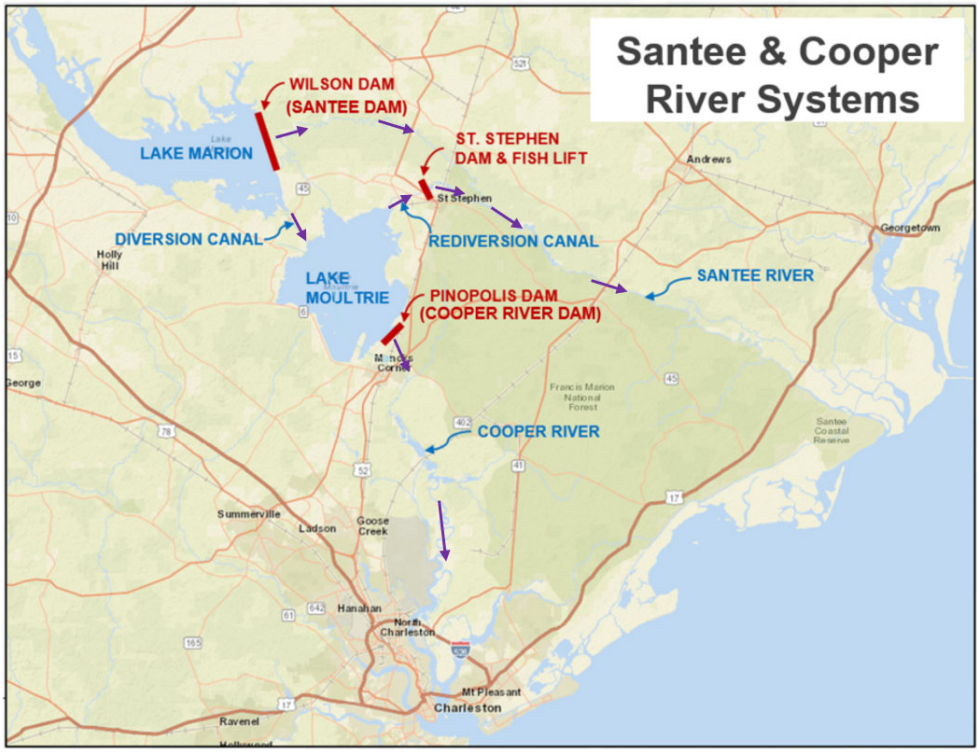



Figure 6. Charleston District project vicinity map.

Figure 7. Cooper River Rediversion Project (USACE photo).

Santee Cooper, officially known as South Carolina Public Service Authority, is responsible for the operation of the Lakes Marion and Moultrie system. They are a state-owned electric and water utility provider that serves the Berkeley, Georgetown, and Horry Counties area. Operational responsibilities of these lakes include operation of Wilson Dam and its spillway, Pinopolis Dam, Jefferies Hydroelectric Station, and the St. Stephen Powerhouse. Santee Cooper remotely operates St. Stephen Powerhouse from their Moncks Corner Headquarters, but USACE is responsible for maintaining the project. South Carolina Wildlife and Marine Resources Department operates the fish lift, with maintenance performed by the Corps. The original project O&M agreement is for a period of 50 years, or less, per a contract between Santee Cooper and the Federal Government. At the end of 50 years, or earlier if a lump sum settlement is reached, Santee Cooper would take over ownership, operation, and project maintenance.

The fish lift facilities, located on the north side of the powerhouse, were intended to provide a means of transferring various species of game and other desirable fish from the power plant tailrace canal to the intake canal and Lake Moultrie. After several years of fish lift operation at the St. Stephen Powerhouse, it was determined that the present facilities were inadequate for transferring the numbers and species of anadromous fish using the St. Stephen tailrace as a migration route to Lake Moultrie. The fish lift did not provide attraction flow in the tailrace, where the desired numbers of fish are likely to be drawn into the fish lift. Modifications to the fish lift were designed and constructed after a study was conducted in 1995. Phase I consisted of the installation of guidance walls at the entrance to the fish lift to reduce the influence of the turbulence and provide safe passage to fish. Phase IIA consisted of the installation of weirs at the end of the new guidance walls to control velocities within a range advantageous to fish passage. Phase IIB, which consisted of a siphon system, provided additional flow to the entrance of the fish lift as well as to outmigration facilities for juveniles. A vertical grate was also installed within the fish lift exit channel in order to cut off fish access to resting areas and prevent the formation of eddies.

Today, the project reduces sedimentation from 10 to 2 million cubic yards of sediment, saving taxpayers $36 million in dredging costs. It also provides electricity to more than 40,000 homes and passes 750k fish annually through its fish lift (Figure 8).

Figure 8. Fish lift at the St. Stephen Powerhouse (Lucia Wimberly, USACE, Charleston District).

## Jacksonville District (SAJ)

The SAJ team provided an overview of water management within the Jacksonville District area of responsibility (AOR). The Jacksonville District encompasses both Florida and the Caribbean with mission areas in flood risk management (inland and coastal), ecosystem restoration, and operations of existing infrastructure such as the Central & South Florida Project. SAJ includes the Kissimmee Chain of Lakes, which run down into Lake Okeechobee, and eventually reaches several water management areas further south (Figure 9).

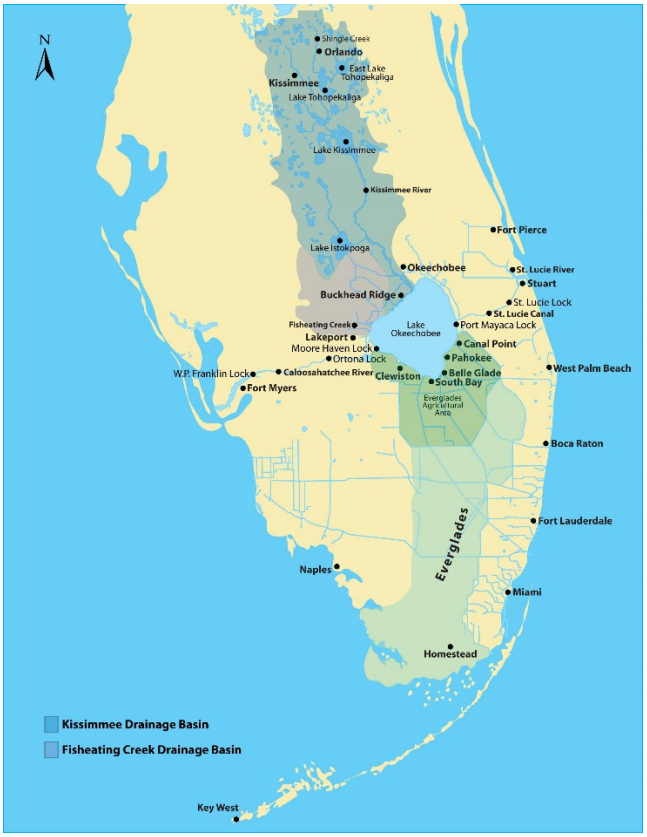



Figure 9. Water system of Kissimmee Chain of Lakes and Lake Okeechobee with flow paths to east, west, and south.

Lake Okeechobee is the nation's tenth largest freshwater lake (by area) and the largest lake in Florida. It is the heart of the Kissimmee-Okeechobee-Everglades system (Figure 10). The lake provides drinking water for surrounding communities serves as a source of irrigation for a $1.5 billion-a-year agricultural industry that produces sugar cane, winter vegetables, citrus and rice. The lake also serves as a source of water for navigation, recreation and for estuaries. Before south Florida was settled, Lake Okeechobee water levels were controlled by natural conditions and events such as rainfall, runoff from the Kissimmee River, evaporation, and outflows south into the Everglades. As the population of south Florida grew and agricultural communities began to thrive, the State of Florida and USACE constructed an array of projects to control the lake's elevation, including Herbert Hoover Dike, a massive earthen berm that surrounds the lake.

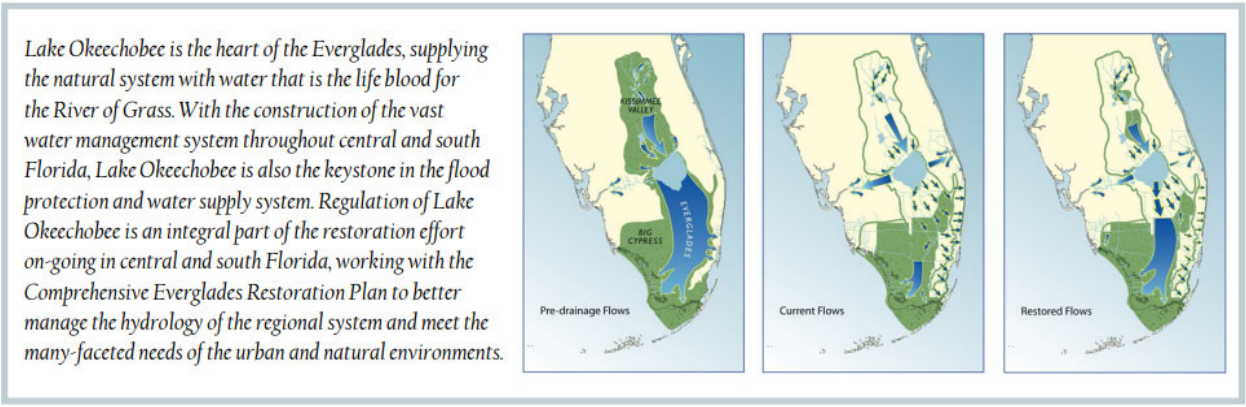



Figure 10. Comprehensive Everglades Restoration Program goals for restored hydrology in South Florida and the Everglades.

Authorized Uses for Lake Okeechobee

- Flood and storm risk management
- Navigation
- Water supply for: Salinity control in estuaries, regional groundwater control, agricultural irrigation, municipalities, industry
- Enhancement of fish and wildlife
- Recreation

Unique Water Management Challenges

In the late 1800s, most waters from Lake Okeechobee drained slowly to the Everglades. However, man-made canals, levees, and the construction of Herbert Hoover Dike changed the runoff drainage patterns for the lake. This presents several water management challenges, including:

- Inflows from the Kissimmee River and other streams frequently exceed the ability of the lake to release water. One foot of rain in a saturated Kissimmee and/or Okeechobee basin can lead to a four-foot rise in the lake level.
- The outflow capacity to the Caloosahatchee and St. Lucie Rivers far exceeds the capacity to send water to conservation areas and the Everglades.
- Water releases are done in a controlled manner due to constraints on capacity and downstream impacts.
- During periods of dry weather, evaporation removes more water from the lake than any type of water release.
- During periods of dry weather, minimum water releases are necessary to keep salt-water content from rising to quantities that are harmful to marine life in the estuaries.

Decision Making Process

The Corps' decision-making process incorporates input from the South Florida Water Management District and other stakeholders to determine quantity, timing, and duration of the potential releases

from Lake Okeechobee includes consideration of various types of data. This information includes, but is not necessarily limited to, the following:

- Central and Southern Florida Project conditions
- Historical lake levels
- Estuary condition/needs
- Lake ecology conditions/needs
- Water conservation area water levels
- Stormwater treatment area available capacity
- Current climate conditions
- Climatic forecasts
- Hydrologic outlooks
- Projected lake level rise/recession
- Water supply conditions/needs

Management of Harmful Algal Blooms

The Corps operates to minimize the health effects associated with HABs to the extent practicable (Figure 11). This operational strategy is proposed to alter the timing and volume of Lake Okeechobee releases to the Water Conservation Areas (WCAs), east, and/or west to allow for greater flexibility with water management decisions when harmful algae blooms (HABs) are present or forecasted in Lake Okeechobee, the St. Lucie or Caloosahatchee estuaries, or the system of canals that connects them. This deviation is not intended to replace any portions of Lake Okeechobee Regulation Schedule (LORS2008).

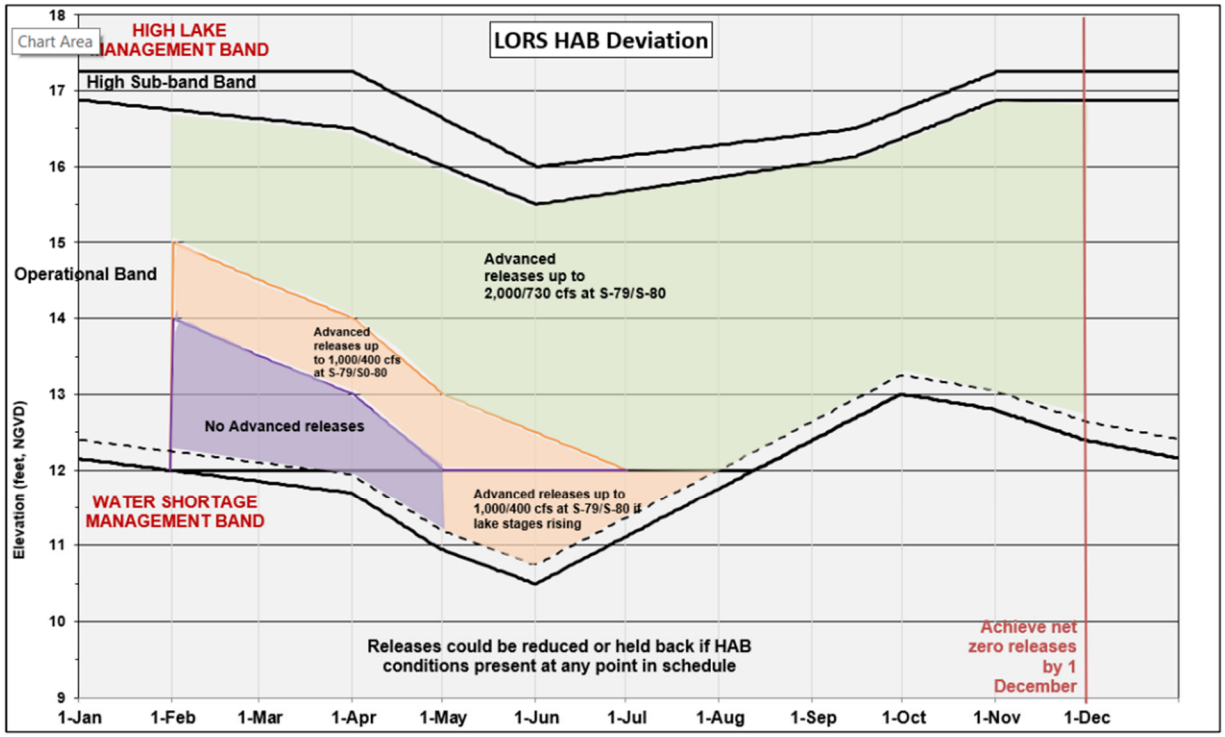



Figure 11. Range of lake stages where and how much east/west advanced releases could occur and at what level.

## Mobile District (SAM)

Within Mobile District, there are 27 federally managed projects as well as 28 non-federal projects on major waterways of the AOR. These federal projects include authorized purposes such as flood risk management, water supply, navigation, recreation, and hydropower. Figure 12 provides a Mobile District map depicting the different water basins as well as key projects.

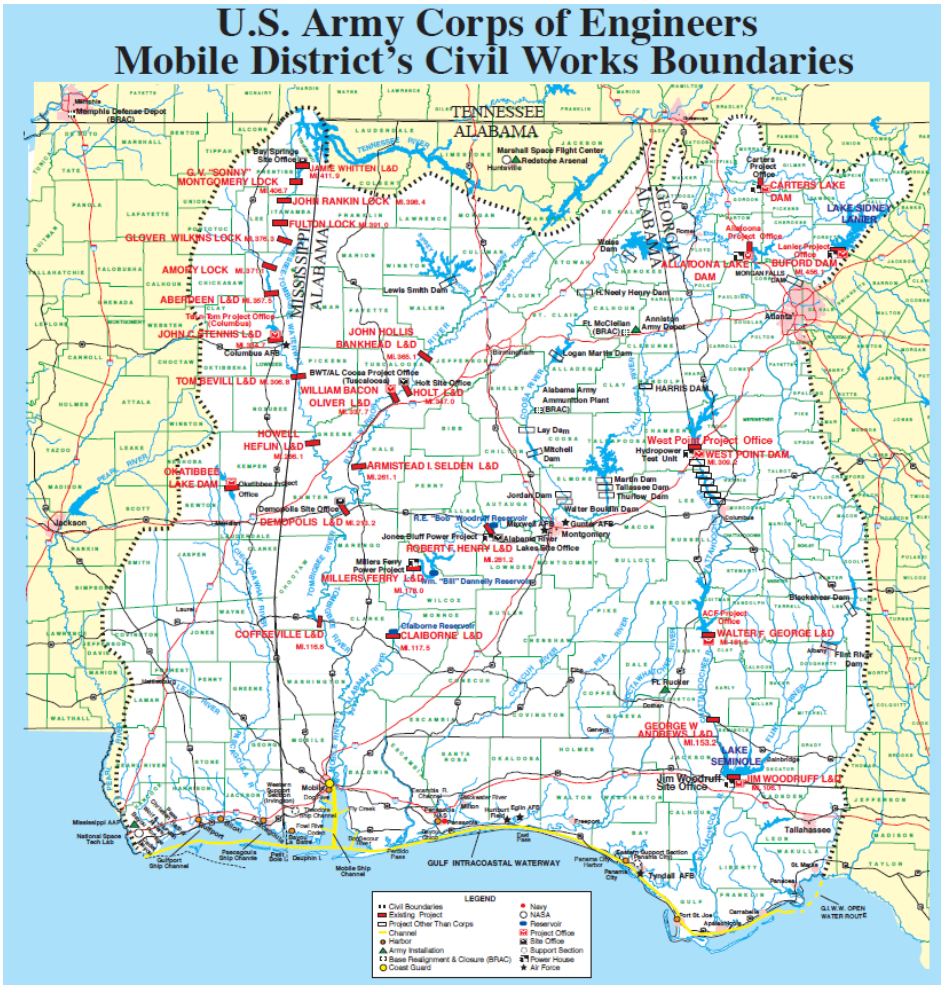



Figure 12. Mobile District project location map.

Within the Apalachicola-Chattahoochee-Flint (ACF) River Basin, in the headwaters, Lake Lanier/Buford Dam minimum flows are maintained during the year below Buford Dam for water quality and water supply to the City of Atlanta. Moving through the system, West Point Lake and Dam implements minimal efforts to aid in environmental mitigation; however, a minimum flow of 670 cubic feet per second (cfs) is continuously released from the project for water quality parameters defined in the Water Control Manual (WCM). Walter F. George Lake and Dam is operated to support downstream water quality deficiencies below the dam. Releases to increase dissolved oxygen (DO) in that reach have been implemented by setting specific procedures for project personnel to follow. When downstream DO falls below a critical point, either a spillway gate is opened or specific generation load is run, depending on

generation demand needs, to increase the DO level. Lake Seminole and Jim Woodruff Lock and Dam drive the upstream system releases. Changes made in the headwaters directly impact and affect the flows below the Jim Woodruff project on the Apalachicola River. Extensive efforts to maintain optimal conditions for threatened and endangered mussel species are followed. Ramp rates to mimic the natural fall of the river as well as daily and weekly elevations change restrictions are implemented based on Environmental Studies conducted during WCM updates.

Within the Alabama-Coosa-Tallapoosa (ACT) River Basin, there are minimum flow requirements below the headwater projects of Allatoona Lake and Dam and Carters Lake and Dam. A minimum flow of 240 cfs is required on both reaches below the projects to support water quality parameters identified by Georgia Environmental Protection Division. At Carters, there is a seasonal varying minimum flow requirements based on the month of the year ranging from 240 to 865 cfs, which was determined by the historical record based on typically wet and dry times annually. Additionally, ramp rates below Carters Dam are implemented to prevent sloughing along the banks, which also maintains water quality parameters. On the Alabama River, three federally managed run-of-the-river projects (R.F. Henry, Miller's Ferry, and Claiborne) operate to meet minimum flows below Claiborne to support a specified 7Q10 flow (the lowest 7-day mean flow that occurs on average once every 10 years) that several industries on the Alabama River have designed effluent discharges based on that dilution flow. Between the upper and lower ACT federally managed projects are 8 Alabama Power Company projects that are operated for hydropower. At several of these locations, easements for flood control exist and flood control operations are reported to USACE during high flow events.

Both the Black-Warrior-Tombigbee (BWT) and Tennessee-Tombigbee Water Way (TTW) are a series of locks and dams authorized and constructed for navigational purposes. Operational procedures of these projects are primarily focused on maintaining pool elevations to support navigation draft depths. Consequently, other project purposes such as recreation are met as ancillary byproducts. Ample opportunities for environmental improvements exist in this area of the district's footprint.

In the Pascagoula River Basin, there is one federally managed project, Okatibbee. This project is authorized for different purposes, including recreation and flood control. In the area surrounding the project, there are multiple locations that can be utilized for environmental mitigation, restoration, and enhancement. Minimum flows below the project are followed to support water quality concerns identified in the WCM.

## Savannah District (SAS)

The Savannah River Basin includes all or portions of 44 counties within Georgia, South Carolina, and North Carolina. Basin area is approximately 10,577 square miles of which approximately 5,821 are in Georgia, 4,581 are in South Carolina, and 175 square miles lie in North Carolina.

USACE's five existing projects on the Savannah River (Figure 13) including the multipurpose dam and reservoir projects and navigation projects on the Savannah River are as follows:

Multipurpose projects:

- Hartwell Dam
    - Dam located at River Mile 305
    - Reservoir covers 55,950 acres at full pool

- Reservoir provides 2,549,600 acre-feet of storage at full pool
- Reservoir provides 1,416,000 acre-feet of conservation storage at full pool
- Power generation of 396,000 kilowatts per hour
- Includes several recreational parks

- Richard B. Russell Reservoir
  - Dam located at River Mile 275
  - Reservoir covers 26,650 acres at full pool
  - Reservoir provides 1,026,244 acre-feet of storage at full pool
  - Reservoir provides 126,800 acre-feet of conservation storage at full pool
  - Power generation of 600,000 kilowatts per hour

- J. Strom Thurmond Dam and Reservoir
  - Dam located at River Mile 237.7
  - Reservoir covers 70,000 acres at full pool
  - Reservoir provides 2,510,000 acre-feet of storage at full pool
  - Reservoir provides 1,045,000 acre-feet of conservation storage at full pool
  - Power generation of 280,000 kilowatts per hour
  - Includes several recreational parks

Navigation Projects:

- Savannah River below Augusta Navigation Project
  - Was authorized to provide a 9-feet depth, 90-feet width
  - Navigation channel that has not been maintained for 30 years and currently inactive
  - The project extends from the New Bluff Lock and Dam (NSBLD) at River Mile 187 to Clyo at River Mile 61
  - Includes one recreational park
  - NSBLD provides control of lock and dam pool

- Savannah Harbor Navigation Project
  - Savannah Harbor handles the largest number of containers of any port on the South Atlantic coast and is 4th in the nation in import and export of container cargo
  - The bar channel is 18.5 miles long, 49 feet deep, and 600 feet wide
  - The inner harbor channel is 21 miles long, 42 feet deep, and 500 feet wide
  - The inner harbor is currently being deepened by 5 feet from its current authorized navigation depth of 42 feet to 47 feet.

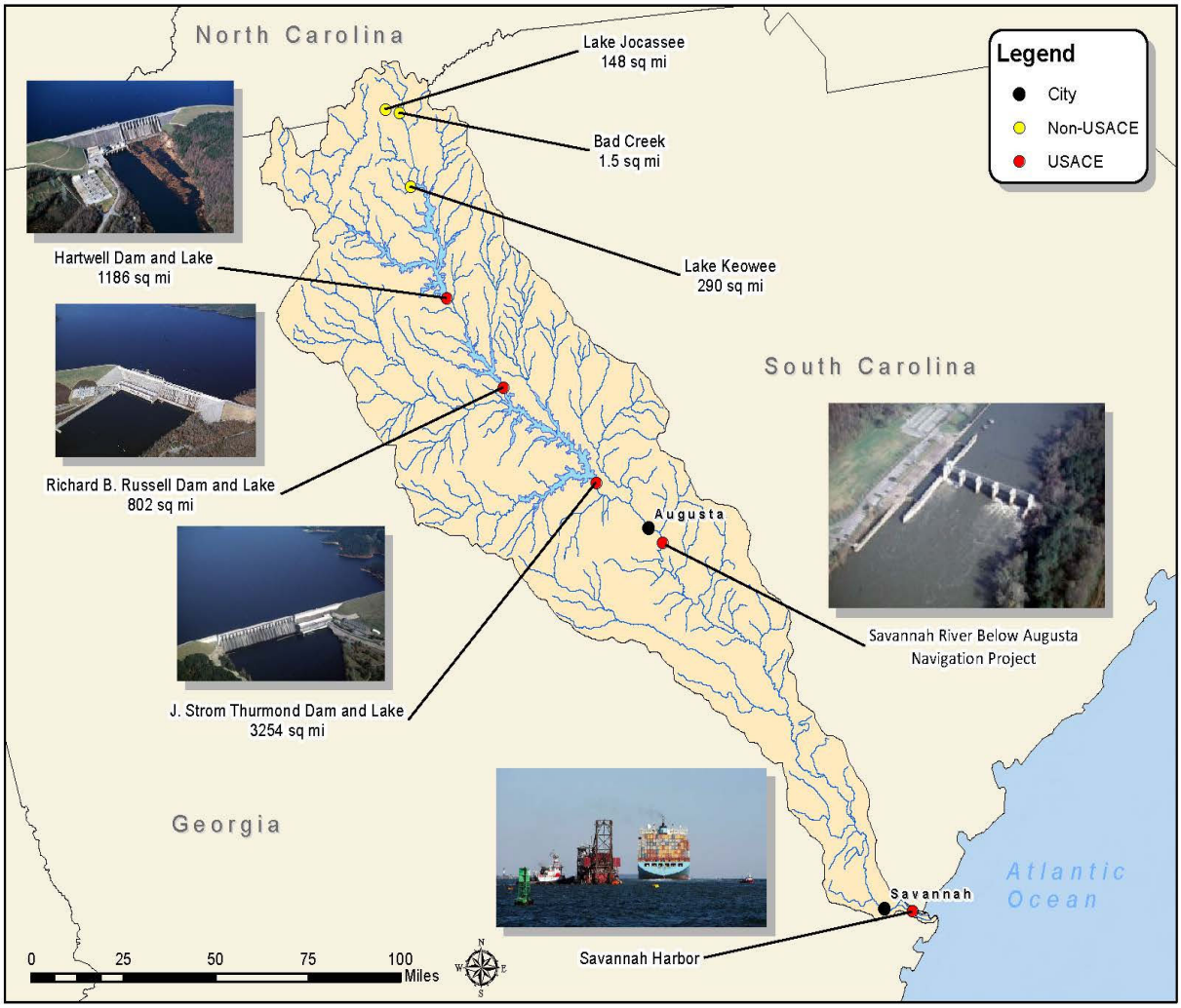



Figure 13. Savannah District project location map.

## Wilmington District (SAW)

The mission of the Wilmington District is to provide quality, professional and comprehensive engineering, construction and other value-added services to our civilian, military and interagency stakeholders, customers and partners across the state of North Carolina and select regions of the Commonwealth of Virginia. SAW has a robust environmental program leveraging water management infrastructure to enhance environmental benefits without compromising authorized purposes at their 5 multipurpose reservoirs (i.e., B. Everett Jordan Dam and Lake (Jordan) on the Cape Fear River, Falls on the Neuse River, John H. Kerr on the Roanoke River, Philpott on the Smith River, and W. Kerr Scott on the Yadkin River) and 3 lock and dams on the Cape Fear River (Figure 14).

Currently, SAW has SRP projects on the Cape Fear and Roanoke Rivers.

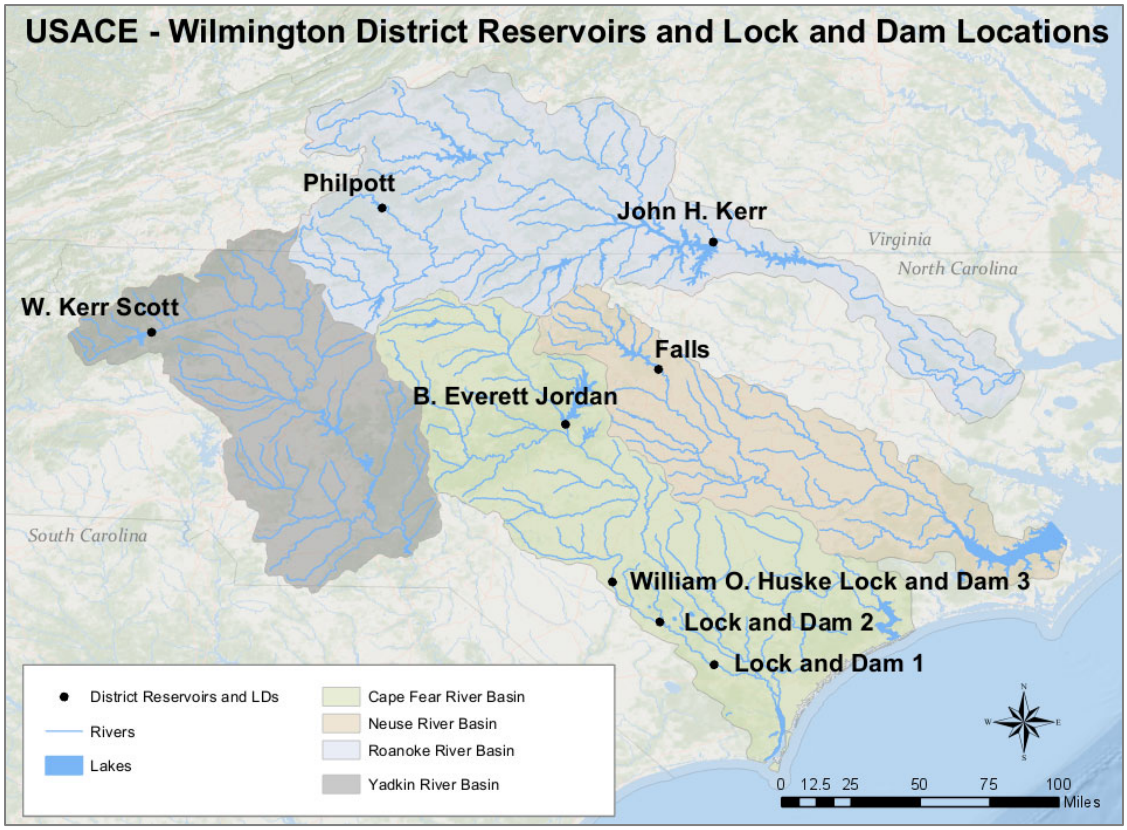


Figure 14. Wilmington District project location map.

SRP work on the Cape Fear River began in 2017 and is currently in the implementation phase, working to identify incorporation opportunities. SRP activities on the Cape Fear River are focused on environmental flows (e-flows) from Jordan and the three lock and dam structures (Figure 15). These facilities are collectively managed for a diverse set of purposes including water supply, flood risk management, water quality, recreation, fish and wildlife conservation and navigation. Early in the SRP process, basin experts identified the locks and dams as barriers to diadromous fish passage. SRP efforts are helping to reverse this trend by adjusting release strategies from Jordan to improve passage conditions for diadromous fishes. The lock and dam structures were also identified as points of concern for water quality conditions, including harmful algal blooms. SRP efforts include e-flow strategies intended to diffuse algal blooms before they become hazardous. During 2020-2022, multiple test pulse releases from Jordan were conducted, and diadromous fish were monitored migrating over the locks and dams. SAW continues to learn how pulses effect the migration of fish under different flow conditions. Multiple test pulses were also conducted during warm summer months, when conditions for algal blooms are favorable, and determines that pulses from Jordan could mix the water column upstream of the locks and dams sufficiently to reduce stagnation and algal bloom formation.

The Wilmington District has partnered with TNC, Clemson University, U.S. Geological Survey (USGS), North Carolina (NC) Wildlife Resources Commission, NC Division of Marine Fisheries, UNC (University of North Carolina)-Wilmington, UNC-Chapel Hill, National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (USFWS), Middle Cape Fear River Basin Association, the Cape Fear

River Assembly, the Cape Fear River Partnership, NC Dept of Environmental Quality, and other stakeholders in support of SRP-related work. All involved are committed to maximizing the benefits to the ecosystem within existing constraints.

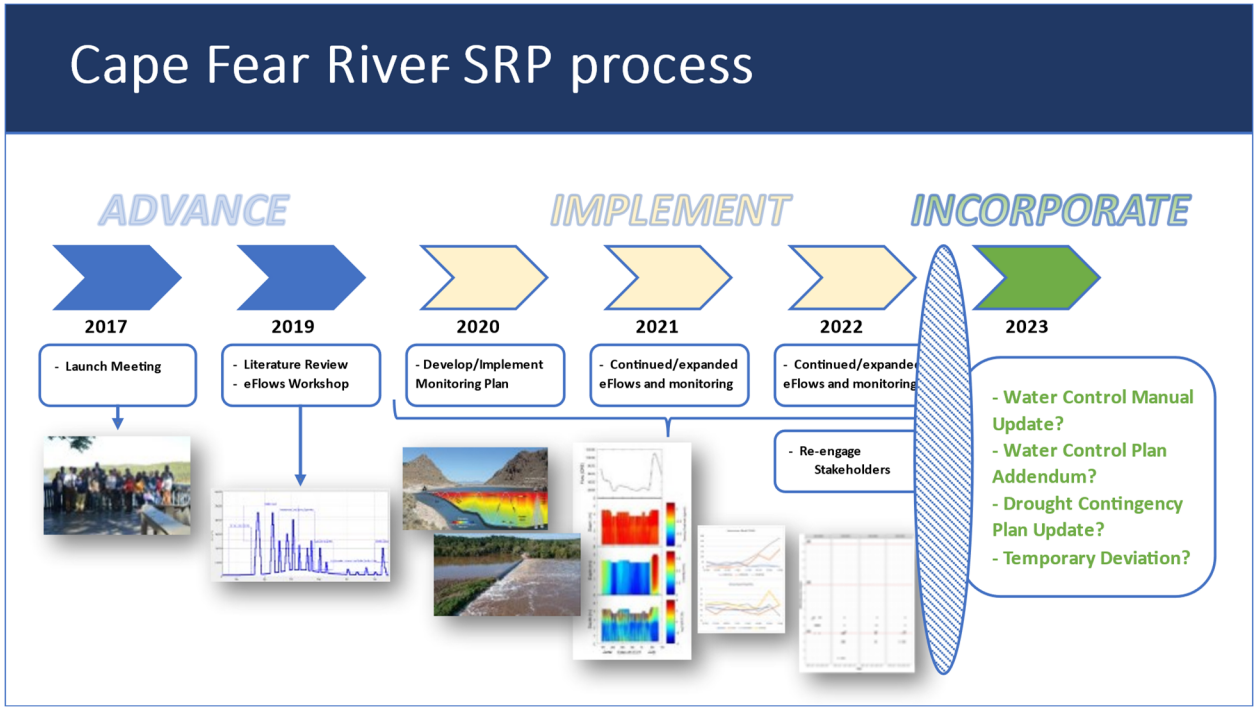


Figure 15. Sustainable Rivers Program work on the Cape Fear River.

The Roanoke River was one of the original eight rivers in the Sustainable Rivers Program. It flows over 400 miles from the Blue Ridge Mountains to the Albemarle Sound, encompassing a drainage area of about 9,600 square miles. The Upper and Middle Roanoke Basins are highly regulated, with multiple private and USACE-owned reservoirs controlling flow. USACE facilities include Philpott Reservoir on the Smith River (a tributary of the Roanoke) and John H. Kerr Reservoir on the Roanoke River. Both are multi-purpose reservoirs, with flood risk management and hydropower as primary operational purposes. The lower Roanoke River flows through a floodplain of national significance, containing "the largest intact and least disturbed bottomland hardwood cypress / tupelo ecosystems on the Atlantic Coast of America". USFWS and TNC own over 95,000 acres in the lower 134 miles of the Roanoke River. This critical floodplain forest habitat was the impetus to identify a management alternative to restore flows that more closely resemble natural river flows. The SRP supported work includes a Quasi-Run-of-River (QRR) flow regime that began in 2016 and shifts the flood control operations defined in the Water Control Plan to release outflows that more closely mimic inflows (Figure 16). This change provides flows that benefit floodplain habitat while still supporting flood control and hydropower missions. QRR was officially implemented in June 2016. SRP continues to support an intensive monitoring program for diadromous fish and juvenile alosine recruitment (blueback herring, alewife, hickory shad) through tracking associations with river flow events and eDNA sampling. SAW has partnered with Duke University, USFWS, TNC, and stakeholders to study the river's geomorphology, floodplain forests, and diadromous fish movement to continue to inform operational changes to better support desired ecological outcomes for the Roanoke River.

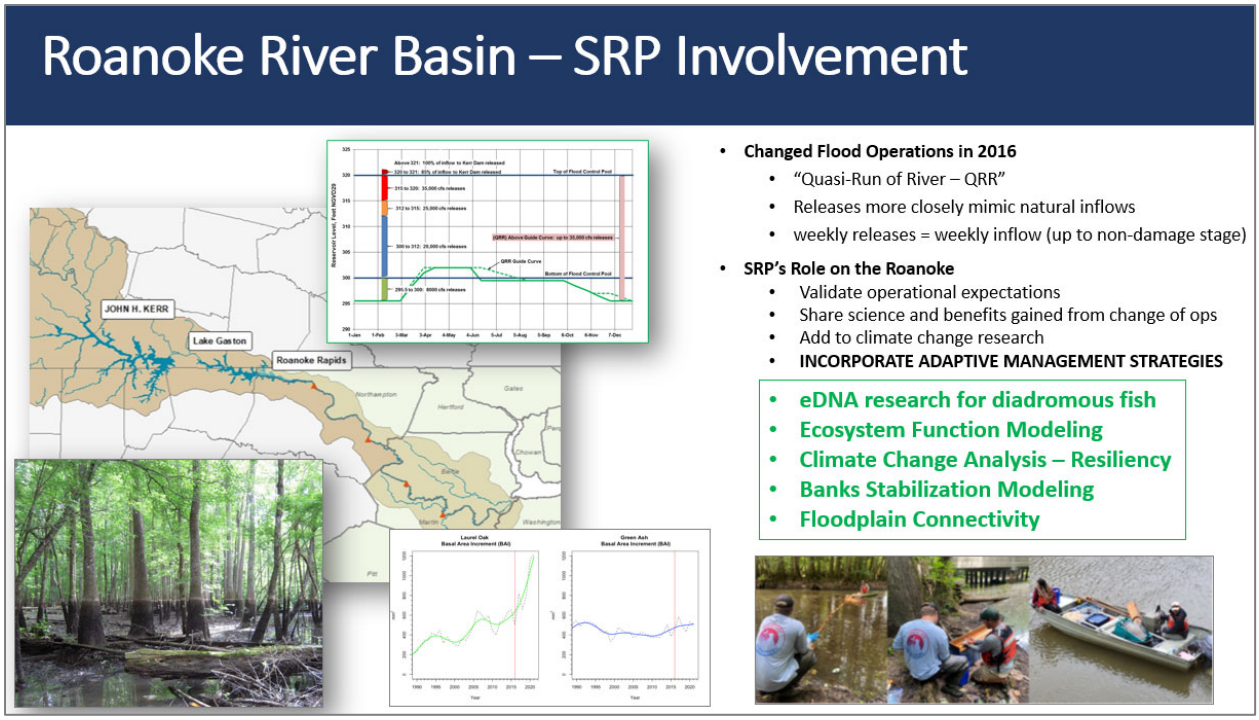



Figure 16. Sustainable Rivers Program supported work on the Roanoke River.

In addition to SRP work, the Wilmington District supports many other efforts to benefit the ecosystems in-lake, in surrounding lands, and downstream of our reservoirs:

- John H. Kerr -- Roanoke River
  - Betterment Plan requires a step down from flood releases to improve water quality
  - Oxygenation system for turbines
  - Dedicated storage for striped bass spawn releases
  - Aquatic Vegetation Management – control invasive and promote native species
  - Stakeholder efforts, such as floodplain connectivity projects, are spillover benefits

- Falls -- Neuse River
  - Minimum release requirement and downstream flow target to support instream flow needs
  - Selective lake level withdrawal to reduce resident time in-lake as well as improve water quality downstream
  - Aquatic Vegetation Management – control invasive and promote native species

- Jordan and Locks and Dams -- Cape Fear River
  - Minimum release requirement and downstream flow target to support instream flow needs
  - Selective lake level withdrawal to reduce resident time in-lake as well as improve water quality downstream
  - Updated Drought Contingency Plan to use water quality pool most efficiently during worsening drought conditions
  - Aquatic Vegetation Management – control invasive and promote native species
  - Rock arch rapids for fish passage at LD1

- W. Kerr Scott -- Yadkin River
  - Aquatic Vegetation Management – planting native species and water quality monitoring
  - Minimum release requirement and downstream flow target to support instream flow needs

- Philpott -- Smith River
  - Roanoke Log Perch population and habitat monitoring above reservoir
  - Aquatic Vegetation Management – control invasive and promote native species

## Environmental Opportunity Matrix and Ongoing Environmental Work

The Environmental Opportunity Matrix was initially developed for use in the Upper Midwest Regional Operations and Water Management meeting. Its intended use is to help identify priority environmental actions and opportunities effectively and comprehensively for the region. The matrix evolved through the subsequent South, Pacific Northwest, North Atlantic, and now South Atlantic regional meetings. Meeting participants were provided a copy of the matrix prior to the meeting and asked to review the list of potential environmental actions and objectives, particularly with a view toward adding any unlisted actions pertinent to Corps water resource infrastructure in the South Atlantic region. At the end of the first plenary session, the matrix was reviewed again by the entire group.

During the first breakout session, each team was asked to use the matrix to consider environmental actions associated with Corps water resource infrastructure in their respective areas of responsibility. Each action was scored based on potential and implementation. Scores are per team; values reflect status for each team's entire portfolio of projects (per reservoir type).

Potential ("Pot.") is a measure of the degree to which an action is likely to produce benefits. Implementation ("Imp.") is a measure of how much of that potential has already been realized. Both measures are reported as either: 0 (none), 1 (low), 2 (moderate), or 3 (high). For potential, a "0" ranking is an activity that has no potential for providing environmental benefits even if it were implemented. For implementation, a "0" ranking means there has been no implementation. In interpreting the scoring, a "3-2" would be a very promising action with moderate fulfillment; a "1-3" would characterize an action with limited possibilities that has already been highly achieved. An implementation value less than 3 indicates that there are unrealized environmental benefits.

Table 4a addresses environmental opportunity at general reservoirs with multiple purpose storage while Table 4b addresses lock and dam and dry dam reservoirs. Green highlighting identifies actions selected by each team for consideration during the next breakout session.

Table 4a. Potential and implementation of environmental actions per location-based team (general reservoirs).

Potential (Pot.) is a measure of the degree to which an action is likely to produce benefits.
Implementation (Imp.) is a measure of how much of that potential has already been realized.

Both measures are reported as either: 0 (none), 1 (low), 2 (medium), 3 (high), or not applicable (n.a.).

Values are per office. In other words, measures of potential and implementation are reported for each office's entire portfolio of projects.

Denotes environmental flow actions and objectives--traditional focus of SRP
Denotes environmental actions selected by location-based teams for per project consideration

| Reservoir Project Types | | Environmental Action/Objectives | SAC | | SAJ | | SAM | | SAS | | SAW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. |
| General | In pool | Support - Water Level management for fisheries | - | - | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| | | Support - Water level management for mussels | - | - | n.a. | n.a. | 3 | 1 | 0 | 0 | 1 | 0 |
| | | Support - Water level management for overwinter biota | - | - | n.a. | n.a. | 3 | 1 | 0 | 0 | n.a. | n.a. |
| | | Support - Water level management for vegetation (riparian) | - | - | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 0 |
| | | Support - Water level management for vegetation (wetlands) | - | - | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 0 |
| | | Support - Water level management for waterfowl | - | - | 1 | 0 | 3 | 1 | 2 | 0 | 3 | 3 |
| | | Support - Water level management for shorebirds, gulls, other migrants | - | - | 3 | 3 | 3 | 1 | 1 | 1 | n.a. | n.a. |
| | | Suppress - Level management for fisheries | - | - | n.a. | n.a. | 2 | 1 | 0 | 0 | n.a. | n.a. |
| | | Suppress - Level management for mussels / oysters | - | - | 3 | 1 | 1 | 0 | 0 | 0 | n.a. | n.a. |
| | | Suppress - Level management for overwinter biota | - | - | n.a. | n.a. | 1 | 0 | 0 | 0 | n.a. | n.a. |
| | | Suppress - Level management for vegetation | - | - | n.a. | n.a. | 3 | 1 | 1 | 1 | 3 | 0 |
| | | Suppress - Level management for waterfowl | - | - | 3 | 2 | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Suppress - Water level management for shorebirds, gulls, other migrants | - | - | 1 | 0 | 0 | 0 | 0 | 0 | n.a. | n.a. |
| | | Pool rate of change management for bank integrity (WQ considerations) | - | - | - | - | 3 | 1 | 0 | 0 | 3 | 2 |
| | | Water Quality - Pathogens | - | - | - | - | 2 | 0 | 0 | 0 | 3 | 1 |
| | | Water Quality - Nutrients | - | - | - | - | 2 | 0 | 0 | 0 | 3 | 0 |
| | | Water Quality - Temperature | - | - | - | - | 2 | 0 | 1 | 1 | n.a. | n.a. |
| | | Water Quality - Management of harmful algal blooms | - | - | 3 | 3 | 2 | 0 | 0 | 0 | 3 | 3 |
| | Connect Up and Down | Manage distribution of depositing sediments (encourage sediment flux) | - | - | 3 | 1 | 3 | 0 | 0 | 0 | 2 | 1 |
| | | Reallocations | - | - | n.a. | n.a. | 0 | 0 | 3 | 0 | 3 | 0 |
| | | Sediment management - bed and bank | - | - | 2 | 1 | 3 | 1 | 1 | 0 | n.a. | n.a. |
| | | Restrict passage of invasives | - | - | 3 | 1 | 3 | 0 | 0 | 0 | n.a. | n.a. |
| | | Debris management | - | - | n.a. | n.a. | 3 | 3 | 0 | 0 | n.a. | n.a. |
| | Downstream | | | | | | | | | | | |
| | *Ecological flow targets* | Geomorphic process support | - | - | 1 | 1 | 3 | 1 | 1 | 1 | 3 | 1 |
| | . | Floodplain connectivity | - | - | 3 | 3 | 3 | 2 | 1 | 0 | 3 | 1 |
| | | Riparian management | - | - | 3 | 3 | 3 | 2 | 1 | 0 | 3 | 1 |
| | . | Wetland management | - | - | 3 | 2 | 3 | 2 | 1 | 0 | 3 | 1 |
| | . | Life stage support - Fisheries | - | - | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 1 |
| | | Life stage support - Benthics | - | - | - | - | 3 | 1 | 1 | 1 | 3 | 1 |
| | . | Life stage support - Mussels / Oysters | - | - | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 1 |
| | . | Life stage support - Waterfowl | - | - | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 1 |
| | . | Life stage support - Shorebirds, Gulls, other migrants | - | - | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 1 |
| | *Ecological flow targets* | Life stage support - Herps | - | - | 0 | 0 | 3 | 3 | 1 | 1 | 3 | 1 |
| | | Rate of change management for bank integrity (WQ considerations) | - | - | 2 | 3 | 3 | 1 | 0 | 1 | 3 | 2 |
| | | Physical habitat creation (use of dredged material, oxbows/floodplain restoration) | - | - | - | - | 3 | 3 | 3 | 1 | 3 | 0 |
| | | Recreation | - | - | 1 | 2 | 3 | 2 | 2 | 1 | 3 | 1 |
| | | Water Quality - Dissolved Gas (management of gas bubble trauma) | - | - | - | - | 3 | 1 | n.a. | n.a. | 3 | 2 |
| | | Water Quality - Nutrients | - | - | - | - | 3 | 2 | n.a. | n.a. | 3 | 2 |
| | | Water Quality - Temperature | - | - | - | - | 3 | 2 | 2 | 1 | 3 | 2 |
| | | Water Quality - Turbidity | - | - | - | - | 3 | 1 | n.a. | n.a. | 3 | 2 |

Table 4b. Potential and implementation of environmental actions per location-based team (lock and dam and CRRP (Charleston, only)).

Potential (Pot.) is a measure of the degree to which an action is likely to produce benefits.
Implementation (Imp.) is a measure of how much of that potential has already been realized.

Both measures are reported as either: 0 (none), 1 (low), 2 (medium), 3 (high), or not applicable (n.a.).

Values are per office. In other words, measures of potential and implementation are reported for each office's entire portfolio of projects.

Denotes environmental flow actions and objectives--traditional focus of SRP
Denotes environmental actions selected by location-based teams for per project consideration

| Reservoir Project Types | | Environmental Action/Objectives | SAC | | SAJ | | SAM | | SAS | | SAW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. | Pot. | Imp. |
| L&D | In pool | Level management for fisheries | - | - | 3 | 3 | 1 | 0 | 1 | 0 | 3 | 0 |
| | | Level management for mussels / oysters | - | - | n.a. | n.a. | 1 | 0 | 1 | 0 | 3 | 0 |
| | | Level management for overwinter biota | - | - | 1 | 1 | 1 | 0 | 0 | 0 | n.a. | n.a. |
| | | Level management for vegetation (riparian, woody, pioneer trees) | - | - | 2 | 2 | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Level management for veg (wetland emergent) | - | - | - | - | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Level management for waterfowl | - | - | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Level management for shorebirds, gulls, other migrants | - | - | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Water Quality - Nutrients | - | - | - | - | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Water Quality - Temperature | - | - | - | - | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Water Quality - Total Dissolved Gas | - | - | - | - | 1 | 0 | n.a. | n.a. | 3 | 0 |
| | | Water Quality - Turbidity | - | - | - | - | 1 | 0 | n.a. | n.a. | 3 | 0 |
| | | Fish Passage Operations | - | - | - | - | 1 | 0 | 3 | 0 | 2 | 0 |
| | | Managing Sediment | - | - | - | - | 1 | 0 | 0 | 0 | 3 | 0 |
| | | Debris management | - | - | - | - | 1 | 0 | n.a. | n.a. | 3 | 0 |
| | Connect Up and Down | Fish Passage | - | - | - | - | 3 | 1 | 3 | 0 | 3 | 2 |
| | | Sediment management - bed and bank | - | - | - | - | 3 | 1 | 0 | 0 | 0 | 0 |
| CRRP (Only Charleston) | Connect Up and Down | Manage distribution of depositing sediments (encourage sediment flux) | 1 | 0 | - | - | - | - | - | - | - | - |
| | | Reallocations | 0 | 0 | - | - | - | - | - | - | - | - |
| | | Sediment management - bed and bank | 1 | 0 | - | - | - | - | - | - | - | - |
| | | Restrict passage of invasives | 1 | 0 | - | - | - | - | - | - | - | - |
| | | Fish Passage | 3 | 3 | - | - | - | - | - | - | - | - |
| | | Debris management | n.a. | n.a. | - | - | - | - | - | - | - | - |
| | Downstream | | | | - | - | - | - | - | - | - | - |
| | *Ecological flow targets* | Geomorphic process support | 2 | 2 | - | - | - | - | - | - | - | - |
| | . | Floodplain connectivity | 2 | 0 | - | - | - | - | - | - | - | - |
| | | Riparian management | 2 | 0 | - | - | - | - | - | - | - | - |
| | . | Wetland management | 1 | 0 | - | - | - | - | - | - | - | - |
| | . | Life stage support - Fisheries | 3 | 0 | - | - | - | - | - | - | - | - |
| | | Life stage support - Benthics | 3 | 0 | - | - | - | - | - | - | - | - |
| | . | Life stage support - Mussels | n.a. | n.a. | - | - | - | - | - | - | - | - |
| | . | Life stage support - Waterfowl | 3 | 0 | - | - | - | - | - | - | - | - |
| | . | Life stage support - Shorebirds, Gulls, other migrants | 3 | 0 | - | - | - | - | - | - | - | - |
| | *Ecological flow targets* | Life stage support - Herps | 3 | 0 | - | - | - | - | - | - | - | - |
| | | Rate of change management for bank integrity (WQ considerations) | 1 | 1 | - | - | - | - | - | - | - | - |
| | | Physical habitat creation (use of dredged material, oxbows/floodplain restoration) | 0 | 0 | - | - | - | - | - | - | - | - |
| | | Recreation | 2 | 1 | - | - | - | - | - | - | - | - |
| | | Water Quality - Dissolved Gas (management of gas bubble trauma) | 3 | 1 | - | - | - | - | - | - | - | - |
| | | Water Quality - Nutrients | 3 | 1 | - | - | - | - | - | - | - | - |
| | | Water Quality - Temperature | 3 | 1 | - | - | - | - | - | - | - | - |
| | | Water Quality - Turbidity | 3 | 1 | - | - | - | - | - | - | - | - |

### Illustration of Reservoir Review

As background and information for the next focus session, a national review of environmental flow potential for reservoirs was presented. The review involved three questions, with each culminating in rankings of all 465 reservoirs with federally authorized flood space. The three questions were: 1) how influential could the reservoir be, 2) in terms of hydrologic alteration, what is the reservoir actually doing, and 3) what is the reservoir able to do? Each of these questions involved a different assessment. All were designed to sort the whole portfolio of reservoirs according to their relative promise as a candidate for environmental flow operations.

The "potential to influence" investigation involved a GIS exercise based on the storage volume of each reservoir and its corresponding mean annual flow at the dam and at points placed along the stream network below the dam. A value of storage divided by mean annual flow was computed at each point. Computed values decreased with distance from dam because the corresponding watershed area and associated mean annual flows increased. Computed values were multiplied by corresponding river reach lengths and summed for the full flow path, from dam to receiving lentic water body. Summed values were then sorted, ranked, and categorized as high, middle, and lower thirds within the region for display purposes (Figure 17).

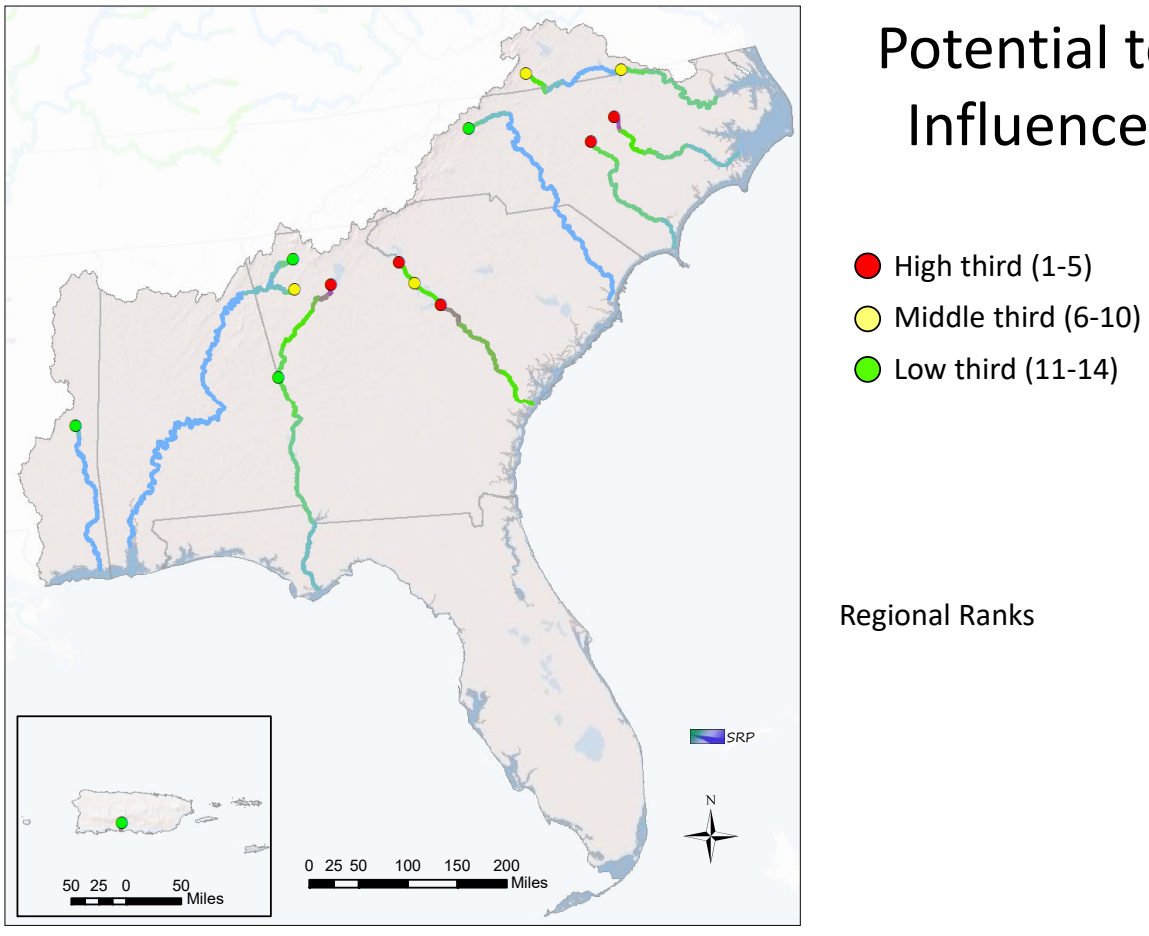



Figure 17. Results of the potential to influence assessment for the South Atlantic region. Categories are based on regional rankings.

The “hydrologic alteration” assessment involved a statistical comparison of reservoir inflows and outflows. Differences in low flows, high flows, monthly volumes, and variability were all computed, expressed as a scale between 0 and 10 and then summed for the four metrics. The resulting sums were sorted, ranked, and categorized as high, middle, and lower thirds for display purposes (Figure 18).

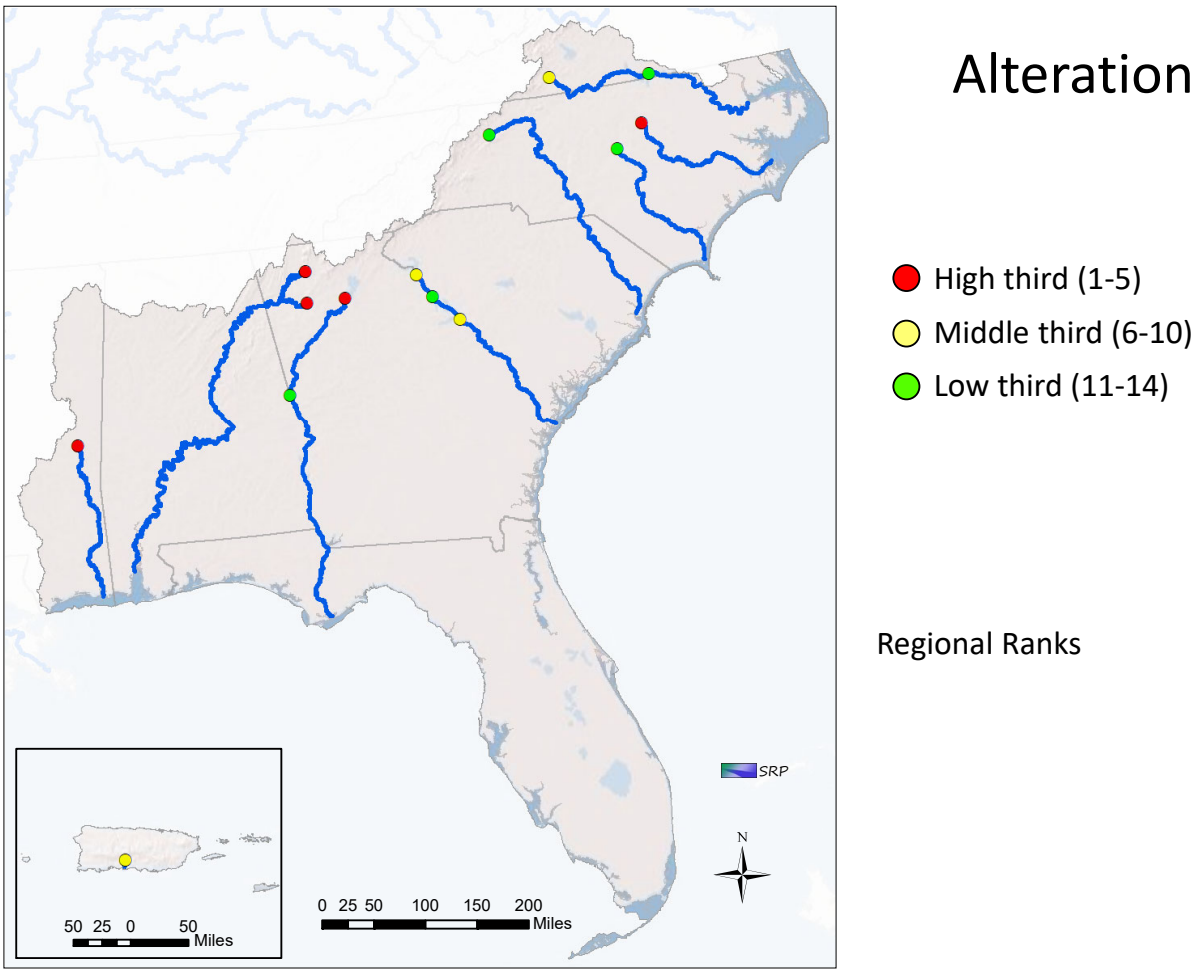



Figure 18. Results of the hydrologic alteration assessment for the South Atlantic Region. Categories are based on regional rankings.

The “characteristics” assessment considered each reservoir’s authorities, operational flexibility, temperature management, fish passage, and channel condition. Reservoirs with federally authorized flood space have an average of 4 and as many as 8 authorized purposes per reservoir. Each authority accrued points for the reservoir (fish and wildlife +5, water quality +2.5, recreation +2.5, and all others -2 each). The total of the points was used as the score for the authorities’ portion of the assessment. Operational flexibility was estimated by computing the percentage of each reservoirs outflow that occurred between 0 and 20% of flood space encroached and then placing the percentage for each reservoir on a 0 to 10 scale. A reservoir’s ability to manage outflow temperatures was scored on a scale from 0 to 10 with 0 being no ability, 5 being limited ability, and 10 being able to operate for water temperature with no expressed limitations. A reservoir’s ability to pass fish was scored on a scale from

0 to 10 based on reported effectiveness, with 10 being free passage. Channel condition involved a comparison of a reservoir's objective flow (high flow limit) and its maximum non-damaging flow. When objective flow was equal to the maximum non-damaging flow a score of 0 was assigned. When objective flow was less than the maximum non-damaging flow the percent difference between the two values increased to a maximum of 10 when maximum non-damaging flow doubled the objective flow (differences greater than double were capped at a score of 10). When objective flow was greater than the maximum non-damaging flow the percent difference between the two values decreased to 0 as the maximum non-damaging flow decreased to 0. Scores for each of the five metrics were summed. Scores for the authorities and operational flexibility metrics were judged to be more important than the other metrics and given two shares each (added twice). The resulting sums were sorted, ranked, and categorized as high, middle, and lower thirds for display purposes (Figure 19).

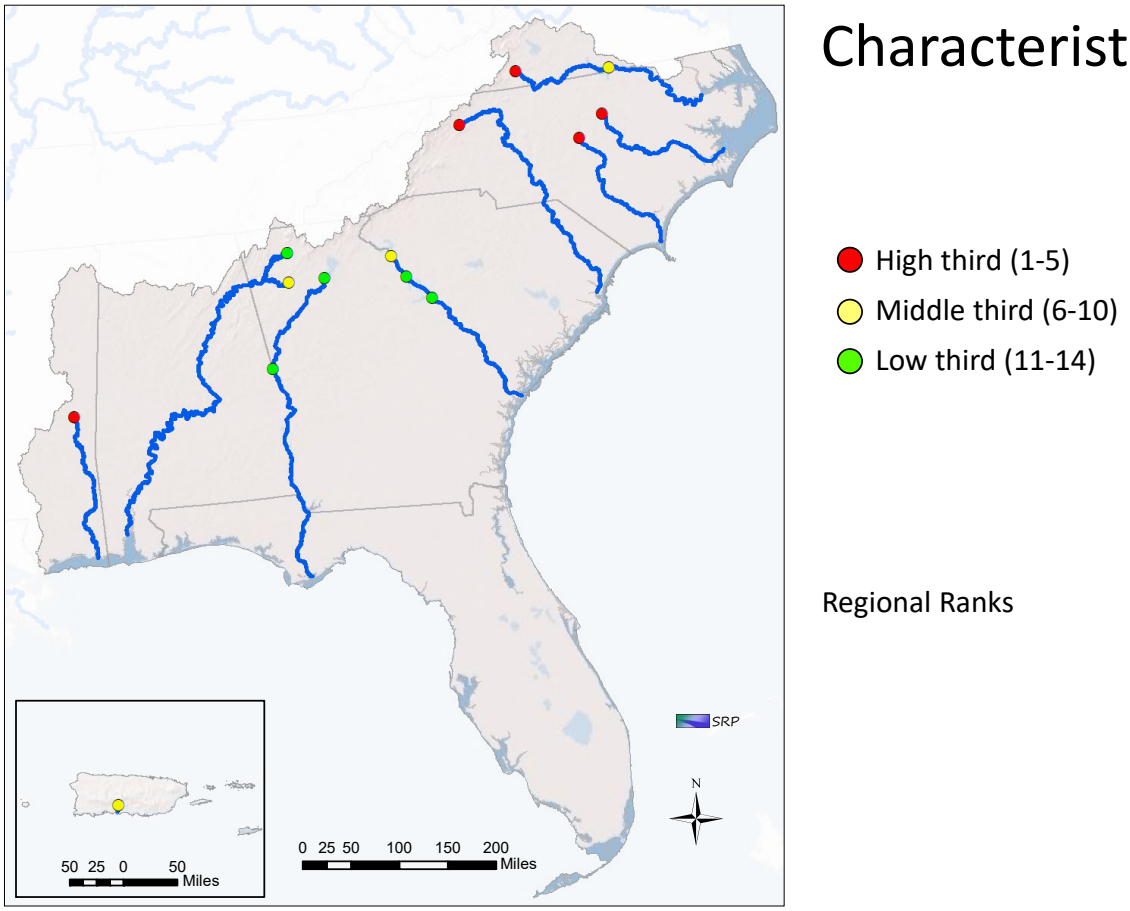



Figure 19. Results of the characteristics assessment for the South Atlantic region. Categories are based on regional rankings.

## Prioritization of Reservoirs

Location-based teams were provided with information from the national review of environmental flow potential and tasked with prioritizing infrastructure within their area of responsibility. Each team selected 3 to 7 environmental actions from Tables 4a and 4b, including "General (Reservoirs) – Downstream – Environmental flows", which was required. Other environmental actions were selected by the teams that have unrealized environmental benefits or were of importance to note.

Teams were tasked with prioritizing reservoirs within their area of responsibility for each selected environmental action. Results for each team are detailed below. Green highlighting shows the priority actionable ideas that are summarized in Table 4.

### Charleston District (SAC)

The following environmental actions were selected for prioritization:

1. Water quality monitoring for dissolved gas, nutrients, temperature, and turbidity
2. Water management actions that promote fish passage
3. Water management actions that promote recreation

Since the Cooper River Rediversion Project (CRRP) is not a reservoir project, there is no potential for in pool environmental benefits. The earthen embankments and concrete gravity dam connect a low flow diversion canal that connect Lake Moultrie to the Santee River. Since Santee Cooper remotely operates the St. Stephen Powerhouse from their Moncks Corner Headquarters, USACE does not have control over the water management actions. A new agreement with Santee Cooper would be required in order to change water management actions for environmental benefits. Therefore, environmental flows were selected as required, but not ranked because that action is not pertinent to USACE responsibilities for CRRP. However, the actionable ideas that were deemed to have the most potential are listed in Table 5.

Table 5. Reservoir prioritization for SAC. Green highlighting indicates actionable ideas.

| Project name | Water quality (downstream) (Pot 3; Imp 1) | Fish passage (Pot 3; Imp 3) | Environmental flows | Recreation (Pot 2; Imp 1) |
|---|---|---|---|---|
| Cooper River Rediversion Project | 1 | 1 | | 1 |

### Jacksonville District (SAJ)

The following environmental actions were selected for prioritization:

1. Management of harmful algal blooms (prevent anoxic conditions in pool)
2. Restrict passage of invasives
3. Manage distribution of depositing sediments
4. Sediment management - bed and bank

Reservoirs were prioritized for each of these actions based on a combination of restoration need and potential ecological benefit (Table 6).

Table 6. Reservoir prioritization for SAJ. Green highlighting indicates actionable ideas. Green highlighting with bold text indicates ideas described in the "Actionable Ideas and Discussion" section.

| Project name | Management of harmful algal blooms (prevent anoxic conditions in pool) (Pot 3; Imp 3) | Restrict passage of invasives* (Pot 3; Imp 1) | Manage distribution of depositing sediments* (Pot 3; Imp 1) | Sediment management - bed and bank (Pot 2; Imp 1) |
|---|---|---|---|---|
| Lake Okeechobee | **1** | **2** | **1** | 1 |
| Water Conservation Area 1 | | 3 | 4 | 5 |
| Water Conservation Area 2A | | 5 | 3 | 5 |
| Water Conservation Area 3A | | **1** | 3 | 4 |
| Water Conservation Area 2B | | 4 | 3 | 5 |
| Water Conservation Area 3B | | 7 | 3 | 5 |
| Kissimmee Chain of Lakes and Kissimmee River | | 6 | 2 | 3 |
| Portugues and Bucana (P&B) Rivers Project | | 8 | 5 | 2 |

* Preventing the spread of invasive species to new areas of the Everglades and early detection and rapid response is key in invasive species management.

* Focus on removal of legacy nutrients during times of drought.

## Mobile District (SAM)

The following environmental actions were selected for prioritization:

1. Fish passage
2. Downstream water quality/minimum flows
3. Downstream floodplain management
4. Downstream rate of change management
5. Sediment management
6. Fish spawning (in pool)
7. Fish spawning (downstream)

Reservoirs were prioritized for each of these actions based on a combination of restoration need and potential ecological benefit (Table 7).

Table 7. Reservoir prioritization for SAM. Green highlighting indicates actionable ideas. Green highlighting with bold text indicates ideas described in the "Actionable Ideas and Discussion" section.

| Project name | Fish passage (Pot 3; Imp 1) | Downstream water quality / minimum flow (Pot 3; Imp 1-2) | Downstream floodplain management (Pot 3; Imp 1) | Downstream rate of change management (Pot 3; Imp 1) | Sediment management (Pot 3; Imp 1) | Fish spawning (in pool) (Pot 3; Imp 2) | Fish spawning (downstream) (Pot 3; Imp 1) |
|---|---|---|---|---|---|---|---|
| Carters Lake | | 14 | | 10 | | 7 | 2 |
| Lake Sidney Lanier | | 1 | | 1 | | **1** | **1** |
| Lake Allatoona | | **2** | | 2 | | 2 | 6 |
| Walter F. George Lake | 7 | 3 | | 9 | | 6 | |
| West Point Lake | | 4 | | 8 | | 5 | |
| Okatibbee Lake | | 6 | **2** | **3** | | 4 | |
| TTW Bay Springs Lake | 9 | 10 | 6 | 7 | 3 | | |
| TTW Canal | 8 | 9 | 4 | 6 | **1** | | |
| TTW River | 5 | 8 | 5 | 5 | 2 | | |
| Seminole (Woodruff) | **2** | 5 | 1 | 14 | | 3 | 5 |
| BWT | 4 | 7 | 7 | 4 | 4 | | |
| ARL Miller's | 1 | 12 | 3 | 11 | 6 | 8 | 3 |
| ARL R.F. Henry | 6 | 13 | 8 | 12 | 7 | | |
| ARL Claiborne | 3 | 11 | 9 | 13 | 5 | | 4 |

## Savannah District (SAS)

The following environmental actions were selected for prioritization:

1. Ecological flow targets (life stage support - fisheries as primary objective)
2. Reallocations
3. Physical habitat creation (use of dredged material for oxbows/floodplain restoration)

Reservoirs were prioritized for each of these actions based on a combination of restoration need and potential ecological benefit (Table 8).

Table 8. Reservoir prioritization for SAS. Green highlighting indicates actionable ideas.

| Project name | Life stage support – fisheries (Pot 3; Imp 3) | Reallocations (Pot 3; Imp 0) | Physical habitat creation (oxbows/floodplain restoration) (Pot 3; Imp 1) |
|---|---|---|---|
| Hartwell Lake | 1 | 1 | |
| J. Strom Thurmond Lake | 2 | 2 | |
| Richard B. Russell Lake | 3 | 3 | |
| New Savannah Bluff Lock and Dam (Savannah River below Augusta Project) | 1 | | 1 |

## Wilmington District (SAW)

The following environmental actions for SAW Lake Projects were selected for prioritization:

1. Environmental flows for water quality
2. Environmental flows for fish passage
3. Sedimentation study for reallocation of the sedimentation pool for environmental flows

Environmental flows for fish passage was of notable interest for Falls Lake given anadromous fish spawning in the Neuse River Basin (even though it was an action associated with locks and dams and Falls Lake is a general reservoir). Environmental flows for water quality and reallocation of the sedimentation pool for environmental flows was deemed important at B. Everett Jordan Lake (Table 9).

Table 9. Reservoir prioritization for SAW. Green highlighting indicates actionable ideas.

| Project name | E-flows – Water quality (Pot 3; Imp 2) | E-flows – Fish passage (Pot 3; Imp 2) | Sedimentation study – Reallocation of sedimentation pool for e-flows (Pot 3; Imp 0) | Bathymetry study – Identify habitat submerged vegetation – Identify extent of habitat for invasive species AND potential for planting natives |
|---|---|---|---|---|
| B. Everett Jordan Lake | 1 | 1 | 1 | 3 |
| Falls Lake | 2 | 2 | 2 | 2 |
| John H. Kerr Reservoir | | | | 5 |
| Philpott Lake | | 3 | 3 | 1 |
| W. Kerr Scott Reservoir | | | | 4 |

The following environmental actions for SAW Locks and Dams Projects were selected for prioritization:

1. Sediment management to support fish passage
2. Modifications to the dam infrastructure for fish passage
3. Connectivity for fish passage via conservation locking

All were of notable interest for William O Huske (Cape Fear River Lock and Dam #3; Table 10).

Table 10. Lock and Dam prioritization for SAW. Green highlighting indicates actionable ideas.

| Project name | Sediment management primarily to support fish passage locking efforts (Pot 3; Imp 0) | Modifications for fish passage (Pot 3; Imp 2) | Locking - Fish Passage (Pot 3; Imp 2) |
|---|---|---|---|
| Cape Fear River Lock and Dam #1 | | | |
| Cape Fear River Lock and Dam #2 | 2 | 2 | 2 |
| William O Huske (Cape Fear River Lock and Dam #3) | 1 | 1 | 1 |

## Trends in infrastructure management and in environmental opportunities

A representative from the South Atlantic Division provided an overview of WCM updates. Practical next steps and funding mechanisms for achieving updates to WCMs with regards to inclusion of environmental strategies were discussed.

## Actionable Ideas and Discussion

In the final breakout session, teams reconvened to further refine their prioritization of reservoirs. Each location-based team identified actionable ideas. An actionable idea is the pairing of a selected **Environmental action** and **Reservoir(s)** deemed to be compelling in accordance with potential environmental benefits and feasible to implement. This section details actionable ideas for each team.

### Charleston District (SAC)

**Water quality monitoring** was scored as "Pot. 3; Imp. 1". Values were assigned because we are currently monitoring the water downstream of the **CRRP** earthen embankments and gravity dam for nutrients, temperature, turbidity, and dissolved oxygen, however we are not currently utilizing this data for environmental benefits.

**Fish passage** was scored as "Pot. 3; Imp. 3". Values were assigned because various species of game and other desirable fish are currently transferred from the power plant tailrace canal to the intake canal and Lake Moultrie from the **CRRP** fish lift facility. After the initial construction and operation of the fish lift,

the adequacy of the fish lift facility was then re-studied in 1995 and implemented new improvements. There is an opportunity to expand the fish lift capabilities.

**Recreation** was scored as "Pot. 2; Imp. 1". Values were assigned as a potential of 2 because the area that can be used for recreation is limited due to the size of the project area, and the need to have restricted areas due to hydropower generation. Some recreation events take place at **CRRP** to include a Sweetgrass Pull, Veterans' fishing day, and a Veterans' dove hunt. During the Veterans' fishing day, the tailrace canal water level is increased to allow easier access to the water. Recreation activities that benefit the environment may be challenging to implement, however there is an opportunity to expand on the recreational efforts while still maintaining the integrity of the tailrace canal.

## Jacksonville District (SAJ)

The SAJ team identified 11 actionable ideas (Table 6, all green highlighting). This section details the 4 of those 11 actionable ideas (Table 6, green highlighting, bold) noted by the team as highest priority (most immediately feasible) and not otherwise being conducted or considered by an ongoing study.

**Management of harmful algal blooms** was scored as "Pot. 3; Imp. 3". The blue green algae crisis has caused substantial and widespread impacts to Florida communities over the last several years resulting in state declared emergencies in multiple counties (Glades, Hendry, Lee, Martin, Okeechobee, Palm Beach, and St. Lucie counties). The State of Florida has formed two emergency task forces to address algal blooms and invested significant resources to develop and implement solutions. The Corps operates **Lake Okeechobee** in order to minimize the health effects associated with HABs to the extent practicable.

**Restrict passage of invasive species** was scored as "Pot. 3; Imp. 1". Invasive species are jointly managed on **Lake Okeechobee**, and responsibility is shared between USACE, the South Florida Water Management District, and the Florida Fish and Wildlife Conservation Commission. The main species of concern are water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia* spp.; Figure 20). Invasive species are a serious threat to navigation, agriculture, public health, flood control, and native plant and animal communities. Managing them on **Lake Okeechobee** and the surrounding areas are imperative to the health of our ecosystem. In addition to the aquatic plant management that occurs as daily operations on **Lake Okeechobee**, SAJ biologists are working towards a future where invasive fish and reptiles can be managed. By limiting these animals' access to new waterways and properties, it will be easier to stop new invasions before they start, preventing far more expensive management actions down the road. There are many potential options for restricting the movement of invasive species on our structures. For example, invasive fishes of specific size classes may be restricted through the installation of mesh over targeted culverts. Furthermore, bubble curtains or noise barriers have been used to prevent entry of fishes into lock and dam structures in other locations and could be applied in targeted areas throughout SAJ's AOR. **Water Conservation Area 3A** was ranked as the top candidate for this action due to its key position as the southwestern most WCA with its connections to Everglades National Park and Big Cypress National Preserve, both of which are likely corridors of spread for existing and future invasive species.

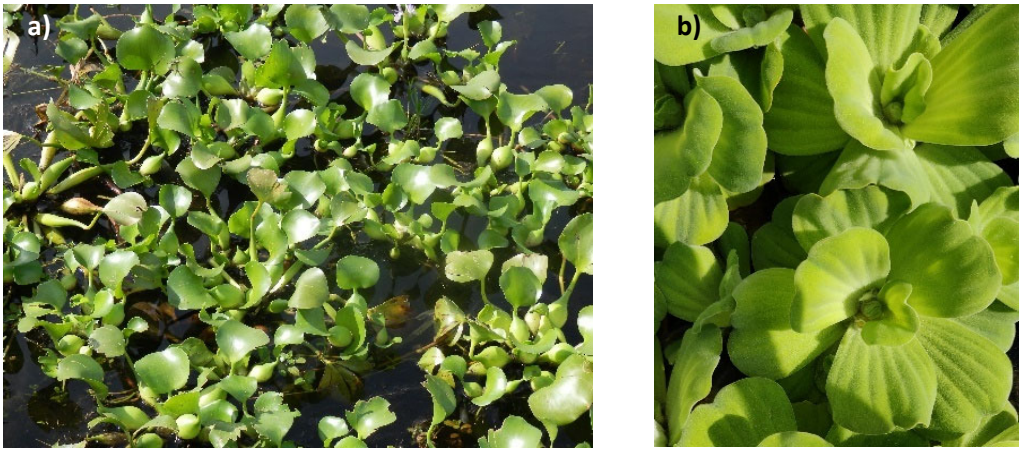



Figure 20. Invasive species of concern in Lake Okeechobee: a) water hyacinth and b) water lettuce.

**Manage distribution of depositing sediments** was scored as "Pot. 3; Imp. 1". The drought starting in 2006, which affected much of the state of Florida, lowered **Lake Okeechobee** levels to an all-time record low of 8.82 feet above mean sea level (July 2007). Periods of drought have occurred on **Lake Okeechobee** about every ten years. The drought actually helped by allowing most of the emergent vegetation that was lost to be replaced by new plants. After Tropical Storm Fay (August 2008), when water levels rose quickly (luckily not too fast to damage new vegetation), thousands of acres of new bulrush, spikerush and other desirable emergent plants covered old established areas as well as many new areas where vegetation had not been in recent memory. Submerged vegetation such as peppergrass and eelgrass returned. With the return of vegetation, many aquatic insect populations also increased, providing a food source for bait fish (such as minnows and shad). With this renewed food source and resurgence in vegetative habitat, many fish have had large spawns since Tropical Storm Fay, causing fisherman to see an increase of many species. Future years should continue to see increased size and numbers of fish assuming habitat and food availability also continue to improve.

The drought of 2007 provided challenges and opportunities for habitat improvement in the lake. The low water levels on **Lake Okeechobee** provided a management opportunity to cost effectively conduct a series of management activities. Continued low water levels in **Lakes Okeechobee** and Istokpoga in south Florida during 2008 prompted the South Florida Water Management District to garner input from a multi-agency perspective about planning low lake stage restoration projects for future dry seasons, as well as to help mitigate the more frequent low lake stages anticipated with the new Lake Okeechobee Regulation Schedule (LORS2008). Broad topics related with low lake level activities were discussed resulting in ten sub teams being identified to further research and formulate projects, including:

- Muck Scraping and Tilling/Disking/Plowing
- Native Aquatic Plant Enhancement
- Exotic and Nuisance Plant Control
- Recreation and Navigation Area Enhancement
- In-Lake Debris Removal
- Apple Snails Enhancement

The Florida Fish and Wildlife Conservation Commission (FWC) and the South Florida Water Management District (SFWMD) have worked jointly since the 2001 drought to enhance the littoral zone marsh of **Lake Okeechobee**. The project objectives fall into two major categories: 1) enhance the fish and wildlife habitat of the proposed area by removing cattail and associated organics that have built up due to lake currents and 2) evaluate the biological succession that will take place in the scraped areas.

Muck Scraping - Continued low lake levels provided opportunities to remove accumulated organic material and muck sediments from the nearshore areas of **Lake Okeechobee** during 2007 and 2008. Once normal water levels return, an improvement in water clarity, emergent and submerged vegetation, fish spawning habitat and wildlife foraging is expected.

Tilling/Disking - The objective of this demonstration project is to restore the essential sand sediments of normally inundated areas of **Lake Okeechobee** by mechanically disking and/or plowing of sediment into the native soils. This process consists of flipping a thick layer of consolidated muck (organic material) underground below native sand. This process shall cap the accumulated sediment below the near shore lakebed. Since these muck areas are exposed due to the drought, they are accessible by plows, tractors and other equipment used to disc and plow the undesirable sediment. The FWC and the SFWMD proposed this project 1) to enhance the fish and wildlife habitat of the proposed area by removing cattail and associated organics that has built up due to lake currents and 2) to evaluate the biological successions that takes place within the scraped areas.

## Mobile District (SAM)

The SAM team identified 27 actionable ideas (Table 7, all green highlighting). This section details the 7 of those 27 actionable ideas (Table 7, green highlighting, bold) noted by the team as highest priority (most immediately feasible) and not otherwise being conducted or considered by an ongoing study.

**Fish passage (connect up and down)** was scored as "Pot. 3; Imp. 1". The SAM team identified **Jim Woodruff** Dam as a promising candidate for this action because previous efforts between the USGS and USACE have shown potential for movement of anadromous species such as Alabama shad. This project would study and integrate fish conservation lockages at **Jim Woodruff** into the management standard operating procedures at Jim Woodruff Lock and Dam.

The SAM team identified **Claiborne** Dam as a promising candidate for this action because there is a current SRP study on the Lower Alabama River studying potential use of the locks and operational changes to move fish up and downstream of the existing structure. A General Investigation study is also being conducted on the Lower Alabama River as a whole to look at structural measures.

**Downstream water quality/minimum flow** was scored as "Pot. 3; Imp. 1". Downstream dissolved oxygen is reduced as water passes from the Forebay to the tailwater through the penstocks at **Lake Allatoona**. Team discussion revealed potential measures that could improve the water quality downstream of **Allatoona** by either spilling or passing water through the sluice gates at **Allatoona**. The study would measure water quality parameters across a variety of operations to determine what

operations maximize DO below the dam. The PDT would then use this information to see what improvements could be made in day-to-day operations to improve DO when it is low.

**Downstream floodplain management** was scored as "Pot. 3; Imp. 1". Currently unmanaged potential habitat north of Center Hill Martin Road could potentially be improved by an updated hydrologic regime and structure retrofitting. This area could be utilized by wildlife and waterfowl when wetted. Currently **Okatibee** is drawn down for flood storage capacity during the winter months. **Okatibee** has a more flexible water control plan than many SAM reservoirs this would allow for the implementation of an SRP style study.

**Rate of change management** was scored as "Pot. 3; Imp. 1" for the reduction of bank erosion and sloughing in the **Okatibee** pool. Currently the USACE is armoring the banks in areas of high erosion, but a more robust hydraulic regime may reduce the need.

**Sediment management** was scored as "Pot. 3; Imp. 1". The **Tennessee-Tombigbee (Tenn-Tom)** is a historically challenging sediment laden system, affecting operations and ecology. Plan will be an extensive literature review with recommendations for future pilot projects and operational changes. The current **Tenn-Tom** SRP study is focusing on the critical habitat around Whitten Lock and Dam, but the team believes an addition study of sediment loading and management is needed at Montgomery Lock.

**Fish spawning** was scored as "Pot. 3; Imp. 1". Integration of fisheries data collected by the state with existing USACE hydrological dataset will identify optimized fish spawn strategies in the **Lake Lanier** Pool. Integration of fisheries data collected by the state and USACE with existing and newly collected hydrological dataset will identify optimized fish spawn strategies for cold water fisheries downstream of the project.

## Savannah District (SAS)

**Environmental flows—Life stage support fisheries** was scored as "Pot. 3; Imp. 3." Values were assigned in consideration of current fisheries management activities within the managed reservoirs and evaluating the possibility of flow targets within the managed reservoirs (**Hartwell, Thurmond,** and then **Russell**) and downstream of the **New Savannah Bluff Lock and Dam** to improve fisheries habitat. Ecological flow targets for fisheries species have been evaluated in the past as part of a recent Savannah River Basin Comprehensive study (an update to the District's Drought Contingency Plan). In collaboration with state and federal resource agencies, there is great potential to re-evaluate those ecological flow targets for all flow events (drought, average, flood) to determine ways to implement those re-evaluated target flows to improve habitat for important fisheries species (sturgeon, robust red horse, etc.) during various life stages: e.g., spawning, rearing, foraging.

**Reallocations** (actions to address known constraints or outdated approaches to water management area) was scored as "Pot. 3; Imp. 0." Values were assigned in consideration of current fisheries management activities within the managed reservoirs. There is high potential to evaluate reallocations of water releases from the reservoirs for ecological benefits such as timing of flow releases to improve water quality for aquatic resources (namely water temperature). The district could update their water control manual to evaluate methods to store the water from the winter longer and then release that water in early to mid-summer to bring down the water temperatures slightly which would improve

overall water quality, namely dissolved oxygen levels, within the reservoirs. This cooling of water temperatures in the summer will not only improve dissolved oxygen levels but will provide better habitat for important fisheries species that use the reservoirs. While there is great potential to evaluate potential reallocations of water to improve water quality and fisheries habitat, this effort would most likely require a study and accompanying environmental assessment (coordination with the public, coordination with the resource agencies, etc.) to evaluate the proposed changes to determine if the proposed changes in water reallocation would not have a significant impact to the human and natural environment. This process could take several years and a substantial budget to complete.

**Physical habitat creation (oxbows/floodplain restoration)** was scored as "Pot. 3; Imp. 1". Restoring cutoff meanders remains an important component of the long-term restoration strategy for the Savannah River and the realization of downstream benefits to dissolved oxygen, nutrient cycling, and fish and wildlife habitat. Restoring flow back into the closed off cutoff bends will improve water quality for wide variety of riverine aquatic resources will reestablish oxbow connection with mainstem of the Savannah River improving overbank flooding interaction. Savannah District has participated in several attempts to reconnect some of these closed of cutoff bends that have been stymied by difficulties finding non-federal sponsors with enough funding to complete the whole process of study, construction, and long-term project operations and maintenance post-construction. This opportunity is most pronounced below **New Savannah Bluff Lock and Dam**.

Wilmington District (SAW)

Actionable ideas were identified for both lake projects and locks and dams projects.

*Lake Projects*

**Environmental flows for water quality** and **Environmental flows for fish passage** were both scored as "Pot. 3; Imp. 2". The **Cape Fear River** was added to the Sustainable Rivers Program in 2017. After a successful launch meeting and environmental flows workshop, SAW has been implementing and monitoring environmental flows via releases from **B. Everett Jordan Dam** to support fish passage over the three Cape Fear River lock and dam structures and to improve water quality issues above the locks and dams that have historically led to harmful algal blooms. With SRP support, SAW is identifying and realizing tangible benefits of the e-flow release strategies from **B. Everett Jordan Dam**. SAW has identified successful fish passage response above all three lock and dams with their releases, and more importantly, have realized that they need less flow to support passage over the structures than estimated previously. Likewise, early monitoring results appear to indicate that releases of much less magnitude and durations than expected may improve water quality conditions above the lock and dam structures. As benefits of our e-flows are being realized in their implementation phase, following extensive monitoring, future efforts are focused on the incorporation phase of SRP. SAW needs continued SRP support to identify alternatives for incorporation and to have conversations with key stakeholders, including the state of North Carolina, who owns the entire conservation pool in **B. Everett Jordan Dam**. This is critical since utilization of the fully allocated conservation pool for water quality pulses could reduce available storage for existing water supply and water quality purposes.

As above, **Environmental flows for fish passage** was scored as "Pot. 3; Imp. 2". **Falls Lake** is a multi-purpose project that is authorized to support flood risk management, water supply, water quality (low flow augmentation), fish and wildlife enhancement, and recreation. Conservation storage is currently fully allocated for water supply and water quality (low flow augmentation releases). Current operations do not officially provide for any special releases related to downstream fish spawning; however, over the past decade or so, water managers have used some discretion during spring spawning to make more favorable releases when the lake is above flood pool based on coordination with fishery resource agencies. This includes more protracted stepdowns in releases and smaller rates of change in releases. A more formal assessment of environmental flows for fish spawning with basin experts and evaluations of opportunities to better integrate spawning releases into the operations of **Falls Lake** would be beneficial for anadromous fish spawning in the Neuse River Basin.

**Sedimentation study - Reallocation of sedimentation pool for environmental flows** was scored as "Pot 3; Imp 0". **B. Everett Jordan Dam** is a multi-purpose project authorized to support flood risk management, water supply, water quality (low flow augmentation), fish and wildlife conservation, and recreation. This action would support a bathymetric survey of the entire **B. Everett Jordan Dam** reservoir. Currently, implementation-phase pulse releases from Jordan dam are supporting anadromous fish passage and water quality improvement efforts on the Cape Fear River under a successful in-progress SRP effort. A sedimentation survey has not been conducted since 1997. An updated bathymetric survey will allow for improved understanding of the current and projected sedimentation pool storage capacity. Knowledge of true available volumes will allow the USACE to make informed decisions regarding water available for future environmental flow-related releases in support of downstream water quality and wildlife enhancement. Similarly, knowledge of true available volumes may influence in-lake water level management in support of future SRP-related environmental enhancement (e.g., riparian plantings, wetland conservation and enhancement).

*Locks and Dams Projects*

**Sediment management to support fish passage and locking efforts** was scored as "Pot. 3; Imp 0". This action would primarily be to develop a sedimentation model at **William O Huske Lock and Dam** to support fish passage locking efforts. Sediment accumulates behind the lock structures, interfering with natural downstream sediment transport and operations of the lock chamber. This model will provide information to help modify lock operations and possibly the structures themselves to avoid sediment accumulation and potentially better mimic natural sediment movement. This may also benefit natural and artificial rocky substrate used by shad and sturgeon as spawning habitat. This work will also build on existing river hydraulics modeling.

**Potential for modifications to infrastructure for fish passage** was scored as "Pot. 3; Imp. 2". Through our SRP-supported implementation and monitoring of environmental flows from Jordan, we have identified successful fish passage and water quality response at the **Cape Fear River Lock and Dam** structures. However, we understand that we are limited in our success with current Jordan water control plan operational constraints. This effort seeks to explore opportunities to modify specifically **William O Huske Lock and Dam** to make submerging the structure easier with less flow, thereby increasing the frequency of successful fish passage events and water quality pulses. An example modification may be to lower the dam to reduce residence time above the structure, thereby reducing opportunity for conditions that create algal blooms. Lowering the dam may also support fish passage,

thereby allowing more frequent opportunities for environmental flows to support effective passage. Another example modification would be to add rock below **William O Huske Lock and Dam** to reduce the head differential over the structure and allow for less flow to support fish passage (this would not need to be to the design level of the rock arch rapids at Cape Fear Lock and Dam 1). This work would build on existing reservoir simulation and river hydraulics modeling (1-D for entire Cape Fear and 2-D at the locks and dams).

**Lock and dam connectivity/Fish passage via conservation locking** was scored as "Pot. 3; Imp. 2". The **Cape Fear River Locks and Dams** were originally constructed to support navigation between the cities of Wilmington and Fayetteville, NC. Since construction, approximately a century ago, they have been a barrier to anadromous fishes that have historically utilized the river for spawning. Species affected include American Shad, Striped Bass, and both Shortnose and Atlantic Sturgeon. This action would allow improved and more efficient conservation locking than is currently attainable. Current conservation lockages at Cape Fear River Lock and Dam 2 and **William O Huske Lock and Dam** are consistently hindered by debris accumulation and manpower shortages. No conservation locking occurs at Cape Fear River Lock and Dam 1 currently due to the existence of a rock arch rapids fish passage. When miter gates and locks are operational the current conservation lockage schedule supports 2 lockages per day at **William O Huske Lock and Dam** and at Cape Fear River Lock and Dam 2, five days per week. Support for this effort could allow for minor debris and sediment management actions to keep miter gates and lock chambers cleared and operable. It could also support additional man-hours to complete and increase conservation locking efforts to effectively move fish upstream.

## Conclusion

The South Atlantic Regional Operations and Water Management Meeting was held February 7-8, 2023. The South Atlantic region is defined as the geographic area containing five Corps Districts within South Atlantic Division (SAD): Charleston (SAC), Jacksonville (SAJ), Mobile (SAM), Savannah (SAS), and Wilmington (SAW). Teams for each District collaborated to determine environmental opportunities at water management infrastructure projects that are feasible to implement and are likely to provide compelling potential benefits. More than 14 reservoirs, affecting flows for over 2,933 river miles within the region, were considered.

In formulating and evaluating environmental opportunities, location-based teams followed these steps:

1. list possible environmental improvement actions associated with reservoirs and water management infrastructure;
2. rate environmental potential of each action;
3. rate degree to which each action has been implemented;
4. select environmental actions with potential and unrealized implementation; and,
5. rank reservoirs and water management infrastructure according to which projects are most promising for operational changes related to selected actions.

A key outcome of the meeting is the list of "actionable ideas", each of which is a pairing of an environmental action with unrealized implementation possibilities at a water management infrastructure project with potential to enact related operational changes. There were 53 actionable

ideas identified during the workshop involving 27 Corps reservoirs, 2 Corps locks and dams, and one "other category", the Cooper River Rediversion Project (Table 1).

This tally is worthy of reflection. In a day and a half, 32 participants identified 53 actionable ideas. In other words, Table 1 includes 53 potential ways to get more environmental benefits from already built, public, water management infrastructure - just do more of this (action) at this location (infrastructure). This does not mean making the changes would be easy or always generate the anticipated benefits. However, these actionable ideas do clearly connect water resources management to ecosystem management and illustrate the unrealized potential of infrastructure to be used as tools in the restoration and management of ecosystems.

It is hoped that the meeting outcomes can be used by district and South Atlantic regional partners to initiate future implementation of as many of the identified actions as possible using the suite of environmental restoration and management tools and authorities at their disposal, including the Sustainable Rivers Program.

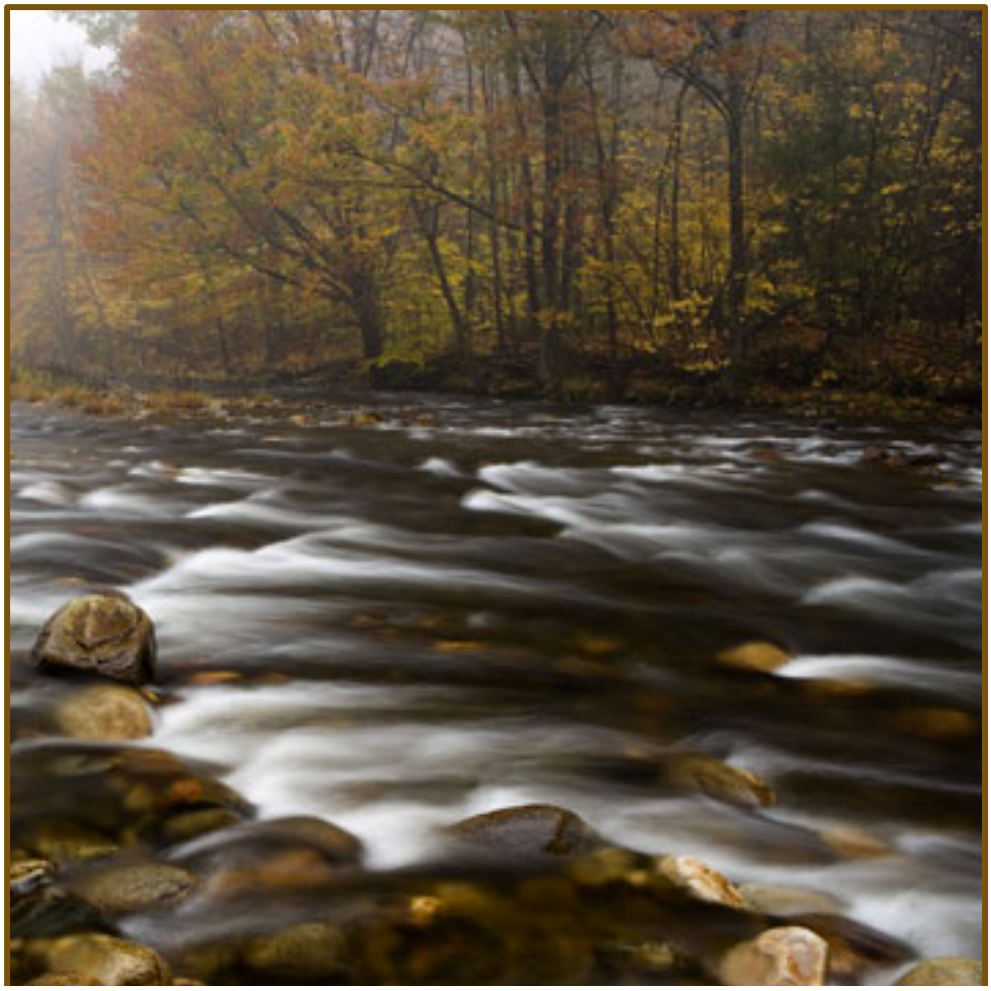
This was the fifth regional meeting supported by the Sustainable Rivers Program. From a Program perspective, the meeting was done to 1) identify environmental opportunities at reservoirs in the South Atlantic and 2) cultivate a forum about environmental considerations at reservoirs. The Corps has several recurring meetings that focus on water management and involve multiple Districts. To the knowledge of SRP, none are specific to environmental considerations. SRP will continue to advance these regional meetings and help implement the resulting ideas with the overall goal of incorporating environmental strategies into the operations of Corps water management infrastructure.

# Appendix A - South Atlantic Region - Operations and Water Management Meeting Participants

| District | Name | Organization | Location-based Team |
|---|---|---|---|
| SAC | | | |
| | Molly Holt | Corps | Charleston |
| | Lindsey LaRocque | Corps | Charleston |
| | Hernan Pena | Corps | Charleston |
| | John Hickey* | Corps | Charleston/Jacksonville |
| SAJ | | | |
| | Chelsea Bohaty | Corps | Jacksonville |
| | Angie Dunn | Corps | Jacksonville |
| | Luis Alejandro | Corps | Jacksonville |
| | John Hickey* | Corps | Charleston/Jacksonville |
| SAM | | | |
| | TJ Rickey | Corps | Mobile |
| | Troy Ephriam | Corps | Mobile |
| | Richard Allen | Corps | Mobile |
| | Randi Robison | Corps | Mobile |
| | Timothy A. Rainey | Corps | Mobile |
| | Jason Throneberry | TNC | Mobile |
| | Charmaine White | TNC | Mobile |
| | Brian Johnson* | Corps | Mobile |
| SAS | | | |
| | Robin Armetta | Corps | Savannah |
| | Scott Hyatt | Corps | Savannah |
| | Melissa Wolf | Corps | Savannah |
| | Jamie Sykes | Corps | Savannah |
| | Stan Simpson | Corps | Savannah |
| | Rheannon Hart* | Corps | Savannah |
| SAW | | | |
| | Stewart Gilmore | Corps | Wilmington |
| | Michael Hosey | Corps | Wilmington |
| | Tasha Alexander | Corps | Wilmington |
| | Dana Matics | Corps | Wilmington |
| | Thomas Nicholson | Corps | Wilmington |
| | Ashley Hatchell | Corps | Wilmington |
| | Tony Young | Corps | Wilmington |
| | Justin Bashaw | Corps | Wilmington |
| | Michelle Mattson* | Corps | Wilmington |
| SAD Rep | | | |
| | Trent Ferguson | Corps | All SAD Teams |

*SRP Team Member

# Appendix B - South Atlantic Region - Operations and Water Management Meeting Agenda



## FEBRUARY 7-8, 2023

# SOUTH ATLANTIC REGION - OPERATIONS AND WATER MANAGEMENT MEETING

Meeting infrastructure that are feasible to implement with compelling potential benefits. Participants provide expertise in reservoir operations, water management, water quality, natural resources management, environmental planning, and ecology. Meeting provides a venue for consideration of environmental actions at rivers and water infrastructure of the South Atlantic Region. goal is to identify environmental opportunities at water

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Sustainable Rivers Program

### KEY EVENT DATES

**SEPTEMBER-OCTOBER COORDINATION WITH PARTICIPANTS**

**NOVEMBER-DECEMBER DISTRIBUTION OF MATERIALS**

**FEBRUARY OPERATIONS AND WATER MANAGEMENT MEETING**

### MEETING LOCATION:

Tybee Island Guard House
31 Van Horne Ave,
Tybee Island, GA
31328

# OPERATIONS AND WATER MANAGEMENT MEETING - SOUTH ATLANTIC REGION

## Tuesday, February 7th, 2023

**9:00 am - 9:30 am**

Introductions and Meeting Objectives. Session includes welcome, introductions, meeting overview, and meeting objectives.

**9:30 am - 10:00 am**

SRP Brief. History and status of the Sustainable Rivers Program (SRP). As of 2022, SRP has engaged 44 river systems and 90+ Corps reservoirs. SRP focuses on environmental flows (environmental flows), including a process for advancing, implementing, and incorporating environmental flows into reservoir operations, while exploring a broader set of strategies about environmental opportunities at water infrastructure.

**10:00 am - 10:30 am**

Regional Rivers and Reservoirs. Results from ongoing GIS analyses are used to summarize rivers and reservoir systems of the South Atlantic Region. Details include number, volume, purposes, and potential influence of Corps reservoirs in region.

**10:30 am - 10:45 am** Break

**10:45 am - 11:30 am**

"Water Infrastructure"-centric Environmental Efforts within Region. SRP efforts in the South Atlantic Region include work on the Roanoke, Cape Fear, Savannah, Alabama, and Chattahoochee Rivers. Session includes presentations about SRP and other environmental projects within region (perspectives from participating Districts).

**11:30 am - 12:30 pm**

Focus Session: Ongoing Environmental Work at Water Infrastructure Projects within Region. Interactive group exercise (with reporting to conclude session) related to current environmental activities. Three topics or questions will be explored:

1) Identify environmental opportunities at reservoirs. Define potential and implementation per office.
2) What opportunities are underrepresented and feasible?
3) What are limitations to implementation?

**12:30 am - 1:30 pm** Working Lunch (at the venue)

**1:30 pm - 2:00 pm** Continuation of Previous Focus Session

**2:00 pm - 2:30 pm**

National Reservoir Review. Review of project authorizations and basic capabilities of Corps reservoirs to operate for environmental purposes, including which reservoirs have fish and wildlife, water quality, and/or recreation as an authorized purpose.

**2:30 pm - 4:00 pm**

Focus Session: Prioritization of Water Infrastructure Projects within Region. Location-based teams will be provided with information from a national reservoir review and tasked with prioritizing candidate infrastructure projects within their area of interest/expertise. Prioritizations will be done for environmental flow potential and two or three of the most promising environmental activities identified in the previous Focus Session. Teams will also develop ideas about how data provided might be applied differently in support of environmental activities.

**4:00 pm – 4:30 pm (tentative)**

Trends in infrastructure management and in environmental opportunities. A representative from South Atlantic Division Office to present on changes and trends in infrastructure management within SAD and provide an overview of environmental opportunities from Division's perspective. What changes, actions, or opportunities do they see coming up in the next 5-10 years.

**4:30 pm** Wrap for day and details about tomorrow.

## Wednesday, February 8th, 2023

**8:00 am - 8:15 am start earlier**

Greeting and Revisit of Meeting Objectives. Session describes meeting goals and activities for the day.

**8:15 am - 8:30 am**

Review of Yesterday. Brief retrospective about yesterday's focus sessions for 1) environmental activities at water infrastructure projects and 2) project prioritizations.

**8:30 am - 10:30 pm**

Strategy Session to Integrate Information. Location-based teams reconvene to finalize thoughts and materials for report out and write up findings.

**10:30 am - 11:00 am** Break

**11:00 pm - 12:00 pm**

Reports from Location-based Teams. Teams will report to group on identified environmental opportunities and candidate infrastructure projects. Actionable ideas will be highlighted.

**12:00 pm - 1:00 pm** Working Lunch (at the venue)

**1:00 pm - 1:30 pm**

Group discussion. Open discussion about meeting products and actionable ideas. Follow-up tasks. Concluding thoughts.

**1:30 pm - 2:00 pm**

Review Regional Meeting Concept. This is the fifth regional meeting done via the Sustainable Rivers Program. Review overall agenda and revisit key components to discuss effectiveness and generate ideas for future meetings. Ideas about meeting goals, construct, and potential would be welcome. Discuss where the meetings outcomes can and should go and can these types of meetings be a platform for anything else.

**2:00 pm** Meeting Adjourned